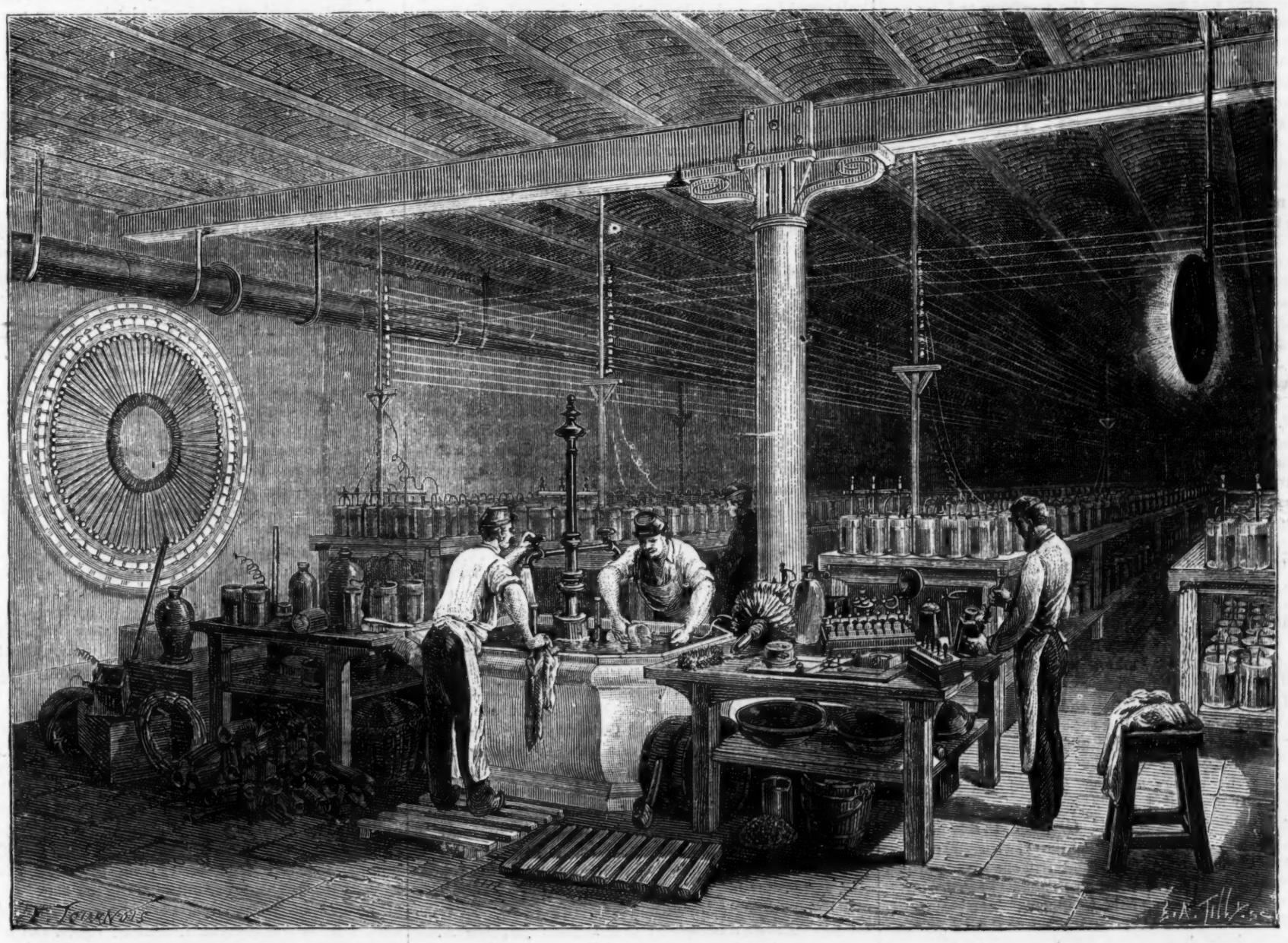
THE ELECTRICAL WORLD

A Weekly Review of Current Progress in Electricity and its Practical Applications

VOL. II.—No. 9. NEW YORK, OCTOBER 27, 1883 $2 PER ANNUM. 5 CENTS A COPY.

A Model Battery Room.

The battery room of a telegraph office is like the boiler room of a factory. It is there that is generated the power which is destined to do the work of transporting the message to distant points. However, like the boiler room, it is apt to receive but little attention, and its appointments are often of the most meagre sort. It is located in some out of the way portion of the building, the basement or the upper story, or some rear extension, as if it were begrudged the space it occupies. Very few of those connected with the telegraph office ever think of the battery room. All that interests them is to know that the current is there, on each circuit, ready to be used. Only those who are intrusted with the care of the batteries, perhaps ever realize the want of facilities and the lack of convenience which characterize the place, in the majority of cases. They are anxious to keep the cells clean, replenished and in good order, and they know that with better appointments the task would be simplified and expedited. As it is, many of the cells suffer from lack of due attention, on account of the time required to go the rounds of a large battery room. With the usual facilities of the average battery room, the operation of cleaning a battery of cells is so uninviting and tedious that we can easily forgive the attendant for delaying it until it becomes a necessity. Meanwhile the local action on the copper-coated zincs, and the layer of zinc sulphate have been increasing, the former causing a waste of zinc and the latter a reduction of power by increase of resistance. The battery room of the main telegraph office in Paris forms an interesting contrast with battery rooms like those we have just described. Our front page illustration, reproduced from *La Lumière Electrique*, represents one-half of this model battery room, situated in the basement of the new building recently constructed for the main office at Paris by the French Government. The cells are of the Callaud or "gravity" type, and the total number in use is over 8,000. They are not all used at the same time, but are connected in groups containing a certain number of even series of varying numbers according to the electromotive force required, arranged multiply or in parallel circuit, so as to diminish the internal resistance of the group. Several lines are connected to each group, each line deriving its current from that group which affords the electro-motive power necessary to produce the proper effect through its resistance. On long lines the number connected in series may be as high as 80 or 90 cells, while the number of such series connected in parallel circuit may be three, four, five or even six. The internal resistance of a multiple group of two series, is one-half, and that of a multiple group of three, is one-third, that of a single series. The reduction of the internal resistance in this manner allows the connection of more lines in parallel circuit to each group. The city lines are provided with a special group of 200 cells, arranged in fifteen series of ten, with an additional portion having twenty cells in series. The rapid and multiple systems are each provided with their special batteries. For the Wheatstone circuits about 70 cells are used. This system, as is well known, works with impulses alternating in direction, but the same battery answers the purpose for both kinds of impulses, being automatically reversed by the apparatus itself. In the Baudot multiple system, which also employs alternating impulses, the battery requires to be in two portions, of 100 cells each, one arranged to give the copper or positive end to the line and the other the zinc or negative end. In addition to these this system also requires about 200 cells for the various local batteries used at different points of the line.



BATTERY ROOM OF THE MAIN TELEGRAPH OFFICE AT PARIS.

The underground wires which the government is now beginning to lay, are provided with a special group of cells, and they also have a separate ground, in a well dug for the purpose. It is believed that this group is in this way more adequately isolated from all disturbing influences

due to the diversion of current from the aerial wires when they ground at the same point. The experience, so far, shows that the underground wires may be worked with weaker currents than aerial wires. They admit the use of more delicate apparatus requiring less current.

The cells in the battery room are placed on long benches or tables each of two shelves, one above the other. Each group is placed by itself, the series of each group being placed side by side across the table. At one end of the group the zincs of the first cell of each series are connected to a common conductor, and at the other the coppers are similarly joined. The wires which serve to convey the current to the switchboard of the operating room or to the special apparatus where it is needed, according to the case, are strung on insulators between posts as shown in the figure. In this way the circuits can be readily singled out and followed, at least as far as the conduit which leads them up to the various rooms above. The ceilings are high, so as to afford plenty of room for these conductors.

In the centre of the battery room, which, by the way, is illuminated by the electric light, is a large fountain, as shown in the illustration. This fountain, it need scarcely be said, proves to be a great boon to the attendants in the work of cleaning the cells, etc. There is a table at the left, on which may be placed the cells cleaned, the chemicals used in replenishing, and whatever implements the attendants desire to have at hand in doing their work.

On the table at the right are placed measuring instruments and testing apparatus of every kind, so that the constants of the cells and groups of cells may be determined conveniently and accurately. The importance of making these tests and of following the suggestions which they indicate seems to be well appreciated also, because in every case the lines are found well adapted to the battery to which they are connected, so far as resistance and electromotive force go, because the available current at the remote end of the line is nearly uniform for all the lines.

The current was measured at the receiving end, by way of experiment, on four lines—one located in Paris, another going to Vannes, the other two of intermediate length, and all gave results comprised between 15 and 19 milli-ampères, or on an average 17 milli-ampères, which shows that for lines varying so much in resistance the ratio remained appreciably constant. This is certainly a record to be proud of, and which might at least lead the managers and superintendents of telegraph offices to take a glance at their own battery rooms to see if something could not be done in the way of systematizing instead of letting the thing take care of itself pretty much as best it may. We have always maintained that if system and proper care will save coal in the boiler room and give more uniform power, the same requirements in the battery room will save zinc and promote a more uniformly efficient working of all the lines supplied from the battery room in question.

The Wonderful Development of the Telephone.

Sir T. Bramwell, at the recent meeting of the British Association, in London, spoke as follows regarding the telephone: Looking at the fact that the telephone was now an instrument in daily use, both commercially and socially, it was difficult, he said, to believe that it was only six years ago that at the Plymouth meeting of this association the telephone was for the first time explained by its talented inventor, Mr. Graham Bell, assisted by Mr. W. H. Preece, the electrician to the Post-office, and thus, although the telephone had now become an instrument of every-day use, it was probably one of the newest instances of the application of science for the purposes of man. Now, however, as the telephone was, it depended, as indeed all inventions did, upon the application of well-known natural laws. But well-known as those laws were, it was necessary to consider some of those which were involved in the construction of the telephone. The first of these which he illustrated by well known experiments was that relating to the generation and transmission of sound. Having fully described the construction and working of the telephones of Prof. Graham Bell and Mr. Edison, and also the photophone, Sir Frederick considered some of the uses of the telephone and described the private line of the Exchange system. He then said, there are also other uses of the telephone. You can use it as the *Times* does, to convey intelligence to the compositor, who has a head-dress, hears what is said to him, and straightway composes it upon the composing instrument. It is obvious that there must be many other uses of the telephone, but you can imagine them. The adoption of the telephone has spread much more rapidly in America than it has here. For example, Washington has a population of about 120,000 white inhabitants and 60,000 colored. This population uses 800 telephones. Everything in Washington is done by telephone, and the people do not seem to know how to get on without it. I am glad to say, although we do things very s'ow here, the telephone is at last progressing in England. The United Telephone Company, in their circular of the 1st of March last, showed that on the 28th of February, 1881, there were connected to the Exchange in London (I am leaving out all private wires) 845 persons; on the same day in 1882, 1,505, an increase of 660, and on the same day in 1883, 2,541, an increase of 1,036 in the year. I think it is clear that that sort of increase ought to go on in more than arithmetical ratio, because the temptation to subscribe must increase with the increase of your speaking power to a large number of persons. No one would care to join if there were only a dozen to speak to; but when it is found that almost every man has a number in the telephone book, you say: "I had better belong to it, because I can then talk to all these people." Therefore, as the numbers increase, this very increase will tempt others to join. With the increased number of subscribers, there comes as a consequence, and all but inevitably, a greater use of the telephone by each subscriber. It appears that in March last the average daily calls of each subscriber was 7.59; each call represents two messages, but if you take it as representing only one, you will find, unless my arithmetic has gone wrong, that a payment of £20 a year represents 2d for each call, or, taking the call and answer, the message each way costs 1d. The number of calls steadily increases and, as I have said, it is obvious that as the number of subscribers increases the frequency of calls will increase from each subscriber, because he has more persons to talk to. Going to another point, that of the line wire connection, the extreme delicacy of the telephone renders it very liable to disturbance by induced currents. I have spoken hitherto of the telephone as though there were always a complete out and home wire circuit, but as a matter of fact the circuit is a wire only one way, and the earth is used the other way. There are certain persons, however, who insist on having an entire metallic circuit. If you use the earth you are liable to a variety of disturbing causes from earth currents, and if you have a powerful dynamo machine, employing the earth as part of its system, in the neighborhood you get some very extraordinary results. To show the great delicacy of the telephone, I may mention that when the telephone was first introduced I was speaking along one, the wire of which was carried on telegraph posts on which there was another wire conveying Morse's signals, and all those Morse signals could be heard in the telephone simply by the induction from one wire to the other. If you have a metallic circuit, and you have the two wires out and home very close together, and if you have them insulated and twist them, you get rid of a great deal of this evil effect, and you do it in an easy, intelligible manner. Suppose the effect of induction from a neighboring wire is to add or deduct from that which is going on in the telephone wire. Think of it as you would of a pair of scales. If you have a pair of scales, and you put one pound on each scale at the same time, you do not disturb the balance. If, therefore, you have these wires close together and close to the disturbing influence, that influence acts equally on both wires, and it is as though you put one pound in each scale at the same time, or took out one pound at the same time, that is, you do nothing at all. In that way you get rid of the difficulty. With respect to the distance through which messages can be transmitted telephonically in March last I was informed from a trustworthy source that 190 miles were being commonly and successfully worked. Since then I have been told, but I do not vouch for it, that as much as 1,000 miles have been experimentally accomplished. I believe that the limit of distance will be found to depend upon the perfection of the insulation and the absence of inductive currents.

Animal Electricity.

Much space is given by our English contemporaries to a lecture on Galvani and Animal Electricity, delivered under the auspices of the British Association at Southport, on the 24th September, by Prof. McKendrick, M. D., F. R. S., Professor of Physiology in the University of Glasgow. The lecturer remarked at the outset that most of the later developments of electrical science may trace their origin to the physiological experiments of Galvani, the professor of anatomy at Bologna, in 1786. Struck by the contractions of frogs' legs in the vicinity of a frictional electrical machine, he wished to study the effects of atmospheric electricity, and accordingly made his first experiment. Then he discovered that there might be a contraction of muscle on the connection of the nerve and muscle by a heterogeneous metallic arc. Then came the notion that the nerves conveyed electricity from the brain and cord to the muscles, and, following the law that the new concepts of a man of science originate from ideas of familiar things, the muscle was forthwith compared to a Leyden jar, the inner surface of which became positive by nervous action, while the surface was negative. Motion was caused by the irritation of a kind of discharge, the positive, internal, surface being connected with the negative, external, surface. Volta doubted this, and held that the phenomena observed by Galvani were due to very feeble currents of artificial electricity produced by the application of heterogeneous metals to the limbs of animals. In the critical inquiry made by Volta into this question, he was led to the invention of the voltaic pile, which not only for a time threw into neglect the question of animal electricity, but also was the starting point of the electrical science of the present day. In 1820 Oersted made the discovery of electro-magnetism. This led to the invention of the astatic needle (Ampère), and of the multiplier or galvanometer (Schweigger); and in 1827 Nobili constructed a galvanometer of great sensibility, by which he could reinvestigate the question of whether or not currents of electricity could be obtain from animal tissues. He found that such currents did exist, and he supposed they were due to thermo-electric action. About ten years thereafter (1837) Matteucci, of Pisa, again investigated the matter, and found that currents could be obtained from animal structures, even where all suspicion of thermo-electric or chemical action was removed. He also discovered that the interior of muscles was negative to their surface, and that it was possible to make a kind of battery of the thighs of newly-killed frogs, which could produce chemical effects similar to those caused by voltaic elements. Then came the labors of Du Bois Reymond, the present professor of physiology in the University of Berlin, which will always mark the commencement of an epoch in the history of animal electricity. Recognizing that the detection of the feeble currents from animal structures depended on the delicacy and accuracy of the apparatus employed, he made many improvements in the construction of galvanometers, and in the arrangements for leading off the currents from living textures into the galvanometer. Such galvanometers must be exquisitely sensitive, and it is evident that just in proportion as they are so, so will be the difficulty of making an arrangement which will lead off any current that may exist, say in living muscles, without causing a current itself. If we apply to a bit of muscle the ends of the copper wires coming from a delicate galvanometer, we either get no effect or an effect due to the action of the muscle substance, or the fluid covering it, on the copper wire. We must have some arrangement which, while touching the muscle, will not cause any chemical change in it, and at the same time will draw off into the galvanometer circuit any current that may come from the muscle itself. That is, the electrodes of the galvanometer must be *non-polarizable*, even when when touching muscle. Du Bois Reymond found that little troughs of zinc, filled with a saturated solution of sulphate of zinc, fulfilled these requirements. Into these are placed bits of blotting paper, also wet with sulphate of zinc solution, and on the bits of blotting paper are placed morsels of clay moistened with saliva. When the bits of clay are put into contact, so as to make a circuit, no current passes through the galvanometer. If we now take a muscle from the back of the leg of a frog, cut it across and place it on the clay pads so that the section of the muscle touches one pad and the surface of muscle the other, a current of electricity passes through the galvanometer, as shown by the swing of the needle. This was shown by the lecturer, a beam from a lime-light being reflected on a screen by a mirror attached to the needles of the galvanometer. It was then shown that an uninjured frog's muscle gives no current; that no current can be got from two uninjured surfaces nor from two transverse sections; but only, speaking generally, when one clay pad touches a section and when the other touches a surface. This may be called the muscle-current. A similar current, though much weaker, can be obtained from living nerve. It was also shown that when a muscle is caused to contract, as it does naturally, the so-called muscle-current is diminished; at all events, suppose the current from a muscle brings the needle of the galvanometer to a certain point, if the muscle then be caused to contract the needle will swing back to nearly its zero point. This reverse—the so-called *negative variation*—indicates that an electrical change in the muscle happens when it contracts. But by refined methods of experiment it has been shown that this change really occurs *before* the muscle contracts, that is, the change in the electrical state of the muscle is an expression of the chemical changes occurring in it, which are antecedent to the muscular movement. The lecturer further showed how it was possible to measure the amount of those changes by Poggendorff's method of compensation, by which a fraction of the current of a Daniell cell was passed through the galvanometer in the reverse direction to the muscle current. Thus, it may be determined that the electromotive force of the natural current of a frog's muscle is about $\frac{1}{8}$ of a volt. Similar currents may be obtained from nerve, although they are very much weaker. Much discussion has ake place as to what these currents really mean: but the majority of physiologists agree with Hermann, of Zurich, in thinking that the current obtained on cutting or injuring the muscle or nerve is really due to the dying of the muscle or nerve substance at the point of section, and that the so-called "negative variation" is the current indicating functional activity. That is, living substance dies at the plane of section, and in dying it acquires a lower potential than the living matter, thus giving rise to a current. Again, suppose a living muscle giving no current on stimulating it, by irritating its nerve, so as to cause the muscle to contract, a lower potential is produced at the points in the muscle where the nerve fibres end, and there is thus a negative variation. Further, it has been shown that this negative variation passes like a wave through the muscle substance, and that the wave has disappeared before the muscle contracts. If, then, electrical changes occur during the activity of muscle and nerve, it is natural that physiologists might expect to detect changes in the beating heart. This is the case. It was shown, by projecting its image on a screen, that the uninjured frog's heart isolated rom the body still lives and, while beating, gave with each beat an electrical variation, as shown by the swing of the galvanometer needle. The uninjured heart gives no current, but when

slightly injured there is a variation in its electrical state with each beat. Then the lecturer showed that light causes an electrical change in the eye. Placing the eye of a frog in the galvanometer cushions, it was shown that there was a current passing from the cornea to the back of the eye. In the dark little or no change could be seen except what might be due to the drying of the living structures forming the eye; on allowing light to fall on the eye, there was at once an increase in the current. This continued for a time, then began to fall off, and on light being removed, there was another increase and then a sudden and rapid fall off. This action, first shown by Professor Holmgren, Professor Dewar and the lecturer, showed a specific influence of light on the retina. It could not be called a negative variation. It indicated chemical changes occuring in the retina. Lastly the lecturer showed the production of currents from the living man. Placing the hands in two vulcanite troughs communicating by platinum plates with the galvanometer, and filled with a weak solution of salt, he showed that on contracting one arm a deflection of the galvanometer needle was produced. When both arms were quiet there was no current; on contracting one arm a current was at once produced. This current the lecturer was inclined to think was due to action of the fluid on the skin, and not to currents from the muscles, and that the differences were due to differences of contact. In summing up, after a few remarks regarding electric fishes, the lecturer said all of these electrical changes were really expressions of the vital changes occurring in living tissues under the action of the stimuli. It was no part of the functions of nerves, muscles, or of the retina of the eye to produce currents under the action of their relative stimuli, but such currents indicated chemical changes in the organs or tissues. For example, the contraction of a muscle is a movement following or consequent upon many chemical changes, among the results of which were the production of heat and differences of electrical potential. Thus, there was no special production of electricity except in the case of electrical fishes, and possibly of some other animals. In most animals, including man, the production of currents was an incidental phenomenon indicating chemical operations and nothing more. Besides, the currents so produced were feeble and evanescent, and bore no relation to the general well-being; consequently, all attempts to influence the living body by magnets had no rational basis. The lecturer had tested this question by powerful electro-magnets, and had not been able to detect that they had the slightest influence on any vital phenomena. It need hardly be added that the so-called phenomena of animal magnetism are of an entirely different kind from those discussed. These are of a subjective character, dependent on peculiar states of the nervous system, having nothing whatever to do with electricity or magnetism, but still in a sense they are phenomena as real as those of physical science. Their subjective character, however, renders them specially difficult of investigation, and consequently they are more liable to fall into the hands of the charlatan. One safeguard against this is the recognition of what the electrical phenomena of the living body really mean, and one purpose of this lecture will be served if it shows that to detect and account for these phenomena requires the most refined methods of the physicist and of the physiologist, and that they give us only a glimpse into the intricate changes occurring in living tissue. The lecture was fully illustrated by experiments in which galvanometers of the most sensitive construction were used.

The Improved Telephonic Apparatus of MM. d'Arsonval and Bert.

Aside from those who invent with the pretension and the endeavor of applying new principles, and producing radically new devices, there are those who are content to take what has already been brought to light as the point of departure and to invent merely for the purpose of applying these principles to the greatest advantage. With the latter, invention is merely a careful study of details to determine where and how a modification of details will afford improvement in the results. Dr. A. d'Arsonval, a learned French scientist, has been studying the several forms of Bell receivers, and his observations have led him to modify the Bell receiver in a very ingenious and scientific manner. In company with M. Paul Bert he has also introduced equally valuable modifications in the carbon transmitter. For the benefit of experimenters and others engaged in this line of study, we reproduce a few details from the pen of Dr. d'Arsonval with illustrations from *La Lumière Electrique*. As early as 1877, soon after the importation of the telephone, Dr. d'Arsonval had noticed that the action on the diaphragm of the receiver was much more energetic when both poles of the magnet acted upon it, and that the best results are obtained when the two poles are flattened in form and brought very close to each other. The Gower-Bell receiver which appeared soon after, and other receivers which have been produced since, have demonstrated the accuracy of this observation. This effect is not due to an augmentation in lifting or attractive power in consequence of the closer approximation of the two poles for the *lifting* power, and the quantity of wire in the bobbins being the same, the results were found more satisfactory with flattened poles than with cylindrical poles. The real cause of the difference appears to be the amount of wire which is situated between the poles, which is evidently the situation where the lines of force of the magnetic field are most densely distributed. This can be easily shown. The two poles of a magnet, separated from each other by a space of a few millimetres, are placed under a sheet iron diaphragm, as in a telephone. Now on taking a wire which is traversed by impulses of alternating current and placing it *between* the poles, the diaphragm vibrates strongly, while, on placing it near the *outside* of the poles, the sound is scarcely perceptible at the diaphragm. It follows therefore that in order to obtain the maximum effects the wire of the helix should be totally submerged in the magnetic field, which should be rendered as dense as possible by a close approximation of the poles. In all the receivers having two poles, such as the Gower, Siemens, Oder, etc., only that portion of the wire situated between the two poles is really useful as just shown, since the lines of force are nearly all concentrated there. The outside part is almost entirely useless and constitutes merely an idle resistance. The telephone receiver of Dr. d'Arsonval (Fig. 1) is constructed with a view to a better disposition and concentration of the magnetic field. The magnet *A* is circular in form, with one end turning inward toward the centre of the circle. This end is prolonged by a pole-piece shown separately at *N*, which forms the core around which the helix *B* is wound. To the other end of the magnet is screwed a pole-piece in the shape of an iron cylinder *T*, which fits around the helix *B* and envelops it entirely.

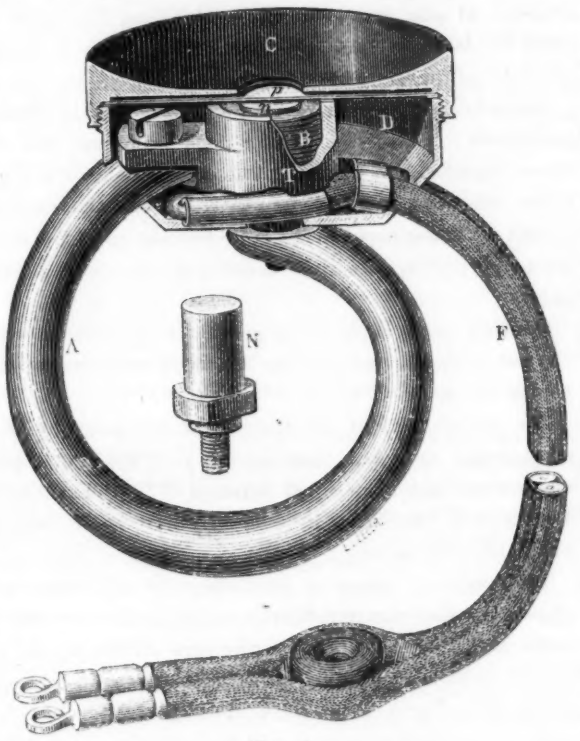


FIG. 1.

The diaphragm *p* is held in place on a simple case *D* by the usual cap *C* and flexible cords *F* are used as with other forms, but these, by a peculiar method of hook connection, dispense with the binding posts usually required. It is seen that in this receiver the magnetic parts are particularly well adapted to the production of a strong magnetic field. In the first place, the circular form of the magnet tends to concentrate the lines of magnetic force at the poles, while by the insertion of one pole into the other the lines of magnetic force are condensed still more and confined in the annular space between them, and as this space is filled by the helix, the sensitiveness of the receiver to the impulses of current is much greater than in any other arrangement. The surprising efficiency of this receiver demonstrates clearly its superiority in this respect. It weighs scarcely 350 grammes (less than seven ounces), and yet it will reproduce the voice with more ease and facility than the best Gower and Bell receivers, and without loss of *timbre*. When provided with a wide-mouthed funnel it may be heard in any part of a large room. Mr. W. H. Preece, who has made some experiments with this receiver, expressed a very favorable opinion of its merits. He states that by thus inducing the wire helix in an annular magnetic field, the effects are much enhanced, but that, nevertheless, the increase in loudness is not followed by loss of clearness of articulation as is ordinariorly the case with other receivers, and that its superior delicacy and accuracy in the reproduction of speech is evinced by the fact that the *th* syllables and articulations so common and so varied in character in the English language are reproduced perfectly and distinctly.

(TO BE CONTINUED).

Another New Telegraph Company.

The International and Northern Telegraph Company was organized in this City October 26th, with a capital stock of $5,000,000. The object is to run telegraph lines through the Northern and Eastern States and into Canada. The directors for the first year are Joseph Owen, of Oswego; U. S. Gilbert, of Jefferson County; Christopher and Howard Meyer, of New York; Isaac Munson, of Watertown; Mahlon C. Martin, of New Brunswick; O. G. Staples, of Washington; John F. Walton, of St. Lawrence County, and John F. Moffett, of Watertown. The officers are: President—Mahlon C. Martin; Vice-President—Orren G. Staples; Secretary—Joseph Owen; Treasurer—John F. Moffett. The incorporators, besides those already mentioned as directors, are: A. D. Remington, President of the Watertown Paper Company; A. W. Clark, ex-Consul at Valparaiso; C. W. Towne, attorney, of this city; William H. Kimball, President of the Canton (N. Y.) Bank; Frederick T. Story, President of the Watertown Gas Company; James T. Searles, banker, of Rome, N. Y.; E. B. Bulkley, President of the Syracuse Iron Company; W. H. Breeden, engaged in the rubber business in this city, and P. C. Onderdonk, a retired rubber manufacturer, of New Jersey. Mr. Owen, the secretary, was formerly for a short time connected with the American Union, having been the promoter of the company which was used as the nucleus of the American Union.

An Exhibition of the Baxter Telephone.

Successful experiments were made last night, says the *Utica Observer*, of the 11th, in long-distance telephoning with what is known as the Baxter telephone. R. D. Buchanan, Secretary of the Overland Telegraph Company superintended the experiments in Utica, and Professor Benjamin Thomson, of New York, an expert electrician and inventor, was at Syracuse. The wires of the American Rapid Telegraph Company were connected with the Baxter instrument in the two cities, and a long conversation was carried on with great ease and distinctness between parties in Utica and Syracuse. No difficulty whatever was experienced from induction, although there are six wires on the poles. Connection was made with Boonville, Waterville and Syracuse, forming a line of eighty miles. This is the system which was used when the feat of telephoning from New York to Cleveland was accomplished. Mr. Buchanan claims that their instruments absorb or overcome sixty per cent. of the induction or "sympathy" between wires. In the experiments made, the wire from the 'phone was run through the switch-board containing twelve or more wires, but the induction did not interfere with conversation which was carried on easily in an ordinary tone of voice.

Buffalo Electrical Society.

The third semi-monthly meeting of the Buffalo Electrical Society was held on the 19th inst. This society was formed for the purpose of promoting the advancement of electrical knowledge among its members. Persons who have little or no knowledge of the scientific principles of electricity, in particular, these meetings are designed to benefit. There are those who have made the science a study, but through long absence from books have let their minds become rusty on the subject, and to these the society will be profitable. The society expects to establish a laboratory, library and reading-room. The meetings are not confined alone to telegraph men, but are open to any one who takes an interest in the subject of electricity. The next meeting will be held on the first Friday in November, at which time it is expected to have a wire run from the Western Union office to a battery in the hall, to enable illustrations to be shown.

Death of Dr. Gale.

Dr. Leonard D. Gale, an old well-known scientist, died in Washington on Tuesday, the 23d inst., at the age of eighty-three. He was at one time associated with Professor Morse in the University of the City of New York, and is said to have brought to the knowledge of the latter in 1834 the discoveries in electricity of Professor Henry, the application of which by Professor Morse to his machine contributed largely to its success. He assisted Professor Morse in building the first telegraph line between Washington and Baltimore. He went to Washington in 1846, having been appointed an examiner of patents, and has since resided there. Until 1857 he had charge of the Department of Chemistry in the Patent Office. In that year he was removed for political reasons, and for many years afterward practiced as a patent attorney.

A New Kind of Electric Engine.

A little two-horse-power electric engine has been on exhibition revolving rapidly at Freeman & Daly's electrical supply office in William street. Its peculiarity is that it has a piston movement engine, exhibited by L. M. Sabin, formerly of St. Louis, who claims that it is the first of that movement which has been manufactured in this country. The engine is supplied from a battery and consists of four electro-magnets—two on each side—with armatures of permanent magnets. While one attracts, another repels, giving the piston movement of the common steam locomotive, and the little engine is similar to this in the remainder of its mechanicism. This engine of two-horse power, Mr. Sabin says, will revolve from 600 to 1,000 times a minute. It cost $150, and the electricity of a storage battery to run it a day of 12 hours will cost, he estimates, 50 cents. It takes up little space, and can easily be placed under a car. The engine is to be tested at once on church organs, propeller or steam yachts, and printing-presses. Its inventor also hopes to adapt it to road carriages and believes that cabs can be run by it for 50 cents a day.

THE
ELECTRICAL WORLD,
PUBLISHED WEEKLY AT
No. 9 MURRAY STREET, NEW YORK.
THE LARGEST CIRCULATION
Of any Electrical Journal in the World.
SUBSCRIPTION, IN ADVANCE, ONE YEAR, $2.00.

Postage to any part of the United States or Canada is always prepaid by the Publisher. Addresses changed as often as desired free. Always give the old as well as the new address.

TRANSIENT ADVERTISING RATES:

Outside page or first advertising page, per inch, each insertion...$2.00
Inside pages..... " " " " " " ... 1.50
Situations Wanted or Help Wanted, per insertion.....$1.00 to 2.00
Business Notices, per line..... 30

Liberal discount on large advertisements or on those running for some time.

Correspondence on all electrical subjects is solicited. Readers are cordially invited to communicate their views and opinions on all topics within the province of this journal. Items of information relating to any application of electrical science will be thankfully received. Our friends will render us a valuable service by forwarding news *promptly* as it occurs, and by mailing us marked copies of their local papers containing anything likely to interest readers of THE ELECTRICAL WORLD. All such matter should be kept separate from letters relating to the business department of the paper, and should be addressed to

"The Editor of The Electrical World, New York."

All communications relating to subscriptions, book orders, advertising, or of a business nature, should be addressed

W. J. JOHNSTON, Publisher,
No. 9 Murray Street, New York.

NEW YORK, OCTOBER 27, 1883.

CONTENTS.

ILLUSTRATED ARTICLES: Page.
A Model Battery Room... 139
The Improved Telephonic Apparatus of M. M. d'Arsonval and Bert..... 141
EDITORIAL:
Vaulting Ambition That Overleaped Itself..... 142
Mobs, Riots and Electrical Appliances..... 142
Telephone Deadheads..... 142
A Word About Copper..... 143
The Volta Prize..... 143
MISCELLANEOUS:
The Wonderful Development of the Telephone..... 140
Animal Electricity 140
Another New Telegraph Company..... 141
An Exhibition of the Baxter Telephone..... 141
Buffalo Electrical Society..... 141
Death of Dr. Gale..... 141
A New Kind of Electric Engine..... 141
The Drawbaugh Patent Case..... 143
Organ Playing by Electricity..... 143
Down-Town Lighting in New York..... 143
The Telephone Consolidation..... 143
The Cummer Engine..... 144
Produce Exchange Telegraph Lines..... 144
The Telephone in Iowa and Nebraska..... 144
The Javan Earthquake..... 144
A Reward of Merit..... 144
Domestic Telegraph and Telephone Co..... 144
The Inventors' Convention..... 144
DEPARTMENTS:
The Telegraph..... 144
The Telephone..... 145
The Electric Light..... 145
Miscellaneous Notes..... 145
ELECTRICAL WORLD'S Illustrated Record of Electrical Patents..... 146

NEW ADVERTISEMENTS.

Curt W. Meyer.—A Scientific Novelty..... 147
W. J. Johnson.—"Electricity as a Motive Power." Just Published..... 147
The Westinghouse Machine Co.—Engines for Electric Lighting Purposes. 154

VAULTING AMBITION THAT OVERLEAPED ITSELF.

When an effort is made to benefit oneself at the expense of somebody else, the great fair-minded public watch the proceedings with interest, and their sympathies are not divided. Should the attempt prove a failure—as fortunately it sometimes does—they hail the result with as much heartiness and pleasure as if the matter were one in which they were personally concerned. In cases where failure is the direct result of the pluck and well-directed exertion of the intended victim, their delight becomes so great that the person or object aimed at, instead of being injured, is very much benefited by the attack. He has met the emergency and come off victorious, and one can't very well help admiring such conduct any more than he can prevent a feeling of contempt for the action that called it forth. Thus a success that ordinarily would take years to perfect is sometimes assured in a single day through the efforts of a would-be rival to outwit or damage a competitor.

We find that our issue of last week has attracted such general and favorable attention as to justify in us some degree of pride and complacency. At the time of its preparation and publication we were simply laboring to give the fullest report of the Telephone Convention at Cincinnati that the circumstances would allow, and to overcome obstacles that any publisher might have been warranted in regarding as insurmountable. When our trying work was ended and we laid before our subscribers that twenty-four page paper, with its elaborate and careful report of the Convention, its minute and accurate description of the exhibits, its lavish profusion of fine cuts obtained under serious difficulties, and its terse summarization of the points of interest, we felt that we had at least done our duty. We said as much, and there were content to let the matter rest.

But our friends do not show themselves disposed to pass over the matter quietly. It will be remembered that Lord Byron went to bed one night a comparatively insignificant poet and woke up next morning to find himself famous. Our little effort seems, from the number of congratulatory letters already pouring in, to have shared the same fate. After all, it was only in keeping with what we had done before—for instance, at the time the Western Union tried to suppress *The Operator*, which some of our readers doubtless remember—and what we intend to do again; but from the stir it has caused we are beginning to think that we builded better than we knew, and to entertain the opinion that what was to us the natural and sequential display of ordinary enterprise really marks, in the public mind, the attainment of another stage in the rapid progress of electrical journalism in this country.

It is against our policy to put in our columns laudatory letters from appreciative readers, or to notice denunciatory attacks from still more appreciative foes. The present occasion is one, however, for establishing the rule by exception, and we take the liberty of quoting a few of the kind things said of No. 8, vol. 2.

One gentleman whose esteem we value highly, writes as follows: "That last WORLD was immense, and the leader dignified and cutting. The enterprise shown about those cuts, and the general report of the Convention, should make the paper many more friends, though I have for a year past believed that it could not be made a *better* paper."

Another gentleman, whose opinion is of weight, says: "I was very glad to receive the copy and congratulate you on the success."

The superintendent of the telephone company in a neighboring city has this to say: "We were especially interested in the last number of THE ELECTRICAL WORLD, and you are deserving of great credit for your push and enterprise."

The general manager of an important inter-state telephone company writes: "Congratulations are certainly in order and due you and your helpers for the energy displayed and the success attending your efforts in bringing out so full a report of the late Convention at Cincinnati. I believe that such enterprise will bring its full reward, both in satisfaction at your success and in the matter of ducats."

And so we might go on. All we will add is that, having raised the expectations of our readers by that issue, we shall endeavor not to disappoint them whenever the hour and occasion calls for like effort, enterprise and outlay.

Mobs, Riots and Electrical Appliances.

Not the least interesting chapter of Carlyle's "French Revolution" is that wherein he treats of mobs. Many of our readers will remember with what wealth of lurid description he shows us the hungry women of Paris in insurrection on that raw October morning in 1789, and how highly he compliments the French mob as among the liveliest phenomena of our world. Under any circumstances, as he says truly, a mob is worthy consideration, no matter how much we may shudder at it, shriek over it or shrink from it; but the rapid, audacious, inventive French mob has distinguished talent in the art of insurrection, its abilities have been remarkably displayed in the ease with which it has overthrown its rulers and governments, and, according to the grim old philosopher of Chelsea, this branch of human industry has been carried to perfection in France.

We, too, have to deal with mobs in this country, and although their insurrectionary virtues or vices may not equal those of the vehement French, their power to work mischief has been deemed a fit subject for serious discussion. It would be absurd to expect from all discontented men, at all times, the brave restraint that the striking telegraphers put upon themselves, and bygone experience has warned the civil and military authorities that an excited, ignorant mob will not hesitate to destroy valuable property or sacrifice life. An evidence of the attention given to this matter is found in the elaborate paper read this month before the Military Institution of the United States, at a meeting held on Governor's Island, by General E. L. Molineux, on the suppression of riots in cities. The essayist chose New York as his example, and he created some sensation by pointing out how helpless modern conveniences may render a community in troublous days. The power of a mob to do damage consists, among other things, in its ability to cut off the supply of light, in the recourse to barricades for offensive and defensive operations, and in the interruption of telegraphic and other communications. He insisted strongly, therefore, on the necessity of making provision to secure the safety of centres from which illuminations are obtained, light being in itself a great protection. General Molineux next gave an argument in favor of underground wires that recalls the policy of the late Emperor Napoleon III., who is said to have given Paris its Haussmann boulevards and its asphalt pavements to prevent mobs from resorting to barricades. "Let us suppose, for example," said the General to his military audience, "that the rioters desired to cut off that portion of territory known as City Hall Park, and to hold in unmolested possession the several government, municipal and public buildings, lying between Chambers and Centre streets, Broadway and Printing House square. All that would be necessary to be done is the pulling or sawing down of the telegraph poles in such manner that they will lie diagonally across the abutting streets, and a formidable mass, a perfect network of wire and timber, will be at once erected, presenting an absolutely impenetrable obstacle to the passage of a body of troops subjected to fire from commanding buildings. Naturally the advantages conferred by the employment of this means of obstruction do not rest wholly with the riotous, but may be used with benefit by the troops. A skillful commanding officer will so dispose this adjunct of defence, arranged in such manner as to permit ready passage for his troops, while being at the same time inaccessible to the opposing force. In the event of the necessity of clearing a street thus encumbered, the simplest and most effective means to be employed would be to attach a rope to the head of the poles, and by means of a purchase from some convenient roof or upper story window to raise the mass, securing it in position sufficiently high to permit free passage beneath it. This presupposes, of course, the having gained possession of prominent buildings—a course which will invariably be pursued by a prudent commander intent upon carrying positions with the least possible loss, and who appreciates the absolute necessity of not permitting rioters to retain control of such points of vantage."

Certainly, putting the wires under ground dispenses with further consideration of this element in the problem, and might also afford relief from another danger to which notice was drawn, the interruption of communication between the police or military headquarters. In the event of the wires being cut, which is not unlikely, other means of communication would have to be devised, but they could not be in any way so prompt and effective in their service as the telegraph or telephone.

It is not necessary that we should go into all the minutiæ of the paper. Our opinion is that General Molineux has given hints that practical electricians can seize upon to the advantage and benefit of the public, and the enunciation of his views will perhaps lead others to bestow thought on the subject.

Telephone Dead-Heads.

One of the most perplexing problems of the telephone service is how to prevent the gratuitous use of the lines and instruments by persons who are not subscribers. This abuse undoubtedly prevails to a very great extent, and adds largely to the work of exchanges. The great difficulty in the way of reform of the evil is that it is aided and abetted by the subscribers, who fail to see the injustice of the practice; or who do not wish to appear churlish by refusing the use of their telephones to friends or acquaintances. The telephone borrowers themselves, probably have no sense of committing a wrong action. They simply fail to regard the matter at all from the ethical standpoint; or, if they do so regard it, the ethical question involved is too subtle to outweigh the great convenience of being able to use the telephone without paying a cent for its use. The average citizen, who sees no wrong in outwitting the customs officers, or in passing his children free on a railroad train if the conductor fails to detect that they are over age, cannot be expected to perceive the moral obliquity of using the telephone for which another man pays, providing the other man is willing. He does not reflect that there is another party to the contract, upon whose rights he is infringing—namely, the telephone company. If he does have a vague impression that there is an ethical principle involved, he calms his conscience by the reflection that he has not sufficient use for the telephone to become a subscriber, and his occasional use of a friend's or neighbor's instrument does not cost the company anything. He does not reflect that there are, perhaps, hundreds of other persons in the same city who reason and act likewise, and whose aggregate use of the lines and instruments not only places a heavy burden upon the employés of the telephone company, but seriously interferes with the rendering of prompt and efficient service to the paying subscribers.

The importance of this question increases with the growth of the telephone service, and it is destined to lead to much vexation and litigation hereafter. It assumed a tangible form in Chicago last week, when Isaac Howland, a livery-stable keeper, filed a bill in the Superior Court against the Chicago Telephone Company, to prevent the company from taking the telephone from his stables. He

says that on the 10th of June last he made an agreement with the company to put a private line and telephone in his livery-stable, agreeing to pay $125 a year rent and all service charges, and not to take any payment from any one else who used it. The complainant in his business finds it necessary to use the telephone very frequently with his patrons, and they in turn use it for ordering carriages, etc. Nearly all of them are subscribers of the telephone company, and when they come to his office they frequently use his instrument in communicating with their houses or places of business or with other subscribers by his permission. The 10th of the present month, Mr. Howland received a notice from the company that on account of the continued use of his telephone by non-subscribers his instrument would be taken away. He charges that he does not allow non-subscribers to use his instrument, but admits he allows his patrons, who are subscribers, to use it and claims he has a perfect right to do so. More than that, however, he thinks the company has no right to say who shall use his telephone at all. He only has a private line, and the company wants him to rent a public telephone at $150 a year, and he thinks this attack on his rights is only made to compel him to pay the extra $25 a year for a public instrument. This he declines to do, both on account of expense and annoyance, and asks for an injunction to prevent the company from removing his telephone or interfering with the unrestricted use of it by himself and his patrons. A temporary injunction was issued. The case is one of concern to all telephonists, who will no doubt await with interest a judicial utterance upon this pressing question. From the standpoint of equity but one decision would seem to be possible, if it can be shown that the complainant was in the habit of allowing non-subscribers to use the line, and of this there would seem to be little doubt, from the position taken by him that the telephone company has no right to say who shall use his telephone.

A Word about Copper.

There can be no doubt that the demand for copper for electrical purposes has enormously increased of late years, and must continue to grow. For instance, the consumption of copper in this country in 1872 was 34,000,000 lbs., while last year it had reached 77,000,000 lbs.; and every one familiar with the subject admits that this increase is largely due to electricity in its extended application. It appears, however, that during the summer the price of copper here has been lower than ever before, reaching 15 cents per lb. for Lake Superior product. In 1864 the price went as high as 55 cents. The contrast is very marked, and we do not wonder that the market now stiffens, and that miners and dealers look for better quotations.

One can easily see that the low price is a strong inducement to the multiplication of electrical enterprises. Probably the Postal Telegraph Company would not care to use a wire requiring 500 lbs. of copper to the mile, if it had to pay 55 cents per lb. It follows that where prices are so low as to increase consumption, the price must move upward, and the more profitable return on mining operations leads in turn to larger output and the exploitation of new fields. At the present time it is said that the English mines are running out, but the supplies are large from Chili, Cuba, Southwestern Europe, Australia, South America and South Africa, and the supply in our Western States has barely been touched. Even should our own mines prove inadequate to the demand on them, the deposits in the West Indies are near enough to be immediately available. Cuba is rich in the mineral, and lodes in the adjoining island of Jamaica, assaying 33 per cent., have yet, as we are informed, to be properly worked. Venezuela, too, is well veined with copper, and other parts of the Southern continent, outside Chili, may in time render up vast stores. Meanwhile we can depend upon it that the opening up of the Lake Superior and other Western regions will give electricians all the copper they want, at reasonable rates.

The Volta Prize.

Among the prizes which the French Academy of Sciences offers periodically for competition by scientific men is the Volta prize, which is awarded to the person making the greatest discovery or realizing the most important application of electricity. The last of these prizes was awarded to Prof. A. Graham Bell, for the invention of the telephone. The *Journal Officiel* announces that the Academy has opened a new competition for this prize, which is of 30,000 francs, which will be awarded for the most economical or practical application of electricity, either in producing heat, light, chemical action, motive power, in the transmission of speech power, or in the treatment of diseases, and the adjudication will be made in December, 1887, the competition to remain open to scientists and artisans of the whole world, without distinction of nationality, until June 30, 1887.

HOLLAND, ITALY AND FRANCE.—Central stations on the Edison system are about to be established at Rotterdam, Amsterdam and Milan. The latter will shortly be in working order, and will supply all the principal establishments of the city. The same system has been established in one of their mines by the Compagnie des Mines de Blanzy, in France.

The Drawbaugh Patent Case.

With regard to this important telephone case, a dispatch from Harrisburg, Pa., of the 21st inst says: The commissioner appointed by the United States Court for the southern district of New York will sit in this city, beginning today, to take surrebuttal evidence in the famous telephone case involving the priority of invention of the telephone, as between Daniel Drawbaugh of this State and Alexander Graham Bell. It is said some 150 witnesses will be called by Drawbaugh's counsel to strengthen their evidence in chief and overcome the rebuttal evidence and cross-examination of Bell's counsel. The taking of this evidence will probably consume two months at least, and how much longer depends on the cross-examination to which Bell's counsel subject these witnesses. The pleas and evidence will then be handed to the court in New York, and the arguments will be made. Senator Edmunds and Judge Hill, of Chicago and Washington, will make the arguments for Drawbaugh, and ex-Senator Conkling, of New York, and Mr. J. J. Storrow, of Boston, for Bell. Probably 10 days will be occupied in hearing the arguments, and it is expected that both Judges Blatchford and Wallace will sit in this case, as it was begun three years ago before Judge Bradford in the Circuit Court, before he was elevated to the supreme bench. The issue in this case is narrowed down to the question "Did Daniel Drawbaugh in 1869 invent a 'talking machine' substantially covering the instruments for which patents were granted to Bell in 1876?" If it is decided in the affirmative, the court will deny the application of the Bell Company to make the temporary injunction against Drawbaugh—represented by the People's Telephone Company—permanent. This decision would not open the telephone to the public, but would enable the People's Company to take the evidence in favor of Drawbaugh into the patent department and demand that Bell be declared out of interference with Drawbaugh, and that a patent be granted to the latter if his claim be sustained. The issue before the court does not settle the question of a patent to Drawbaugh, but simply as to the priority of invention between him and Bell, and whether the latter can prevent Drawbaugh from doing business.

Organ Playing by Electricity.

The Cathedral of the Incarnation, the Stewart Memorial at Garden City, L. I., has an organ reputed the largest in the world. It has 115 speaking stops and 7,252 pipes. Its cost exceeds $100,000. The whole of it, though it is distributed in four distinct and widely separated parts of the cathedral, is placed under the control of one performer by means of the Roosevelt electric action. Steam power is employed in the process of inflating the bellows. There are double engines of ten horse-power placed beneath the chancel division, to supply it alone with compressed air, whose speed is governed as far as possible by the rise and fall of the bellows. In addition to this, the feeder pallets are so arranged that should the cessation of the demand for wind be too sudden for the engines to slacken their speed correspondingly, no evil effects will result. In the room beneath the vestibule, and which is directly under the tower division, is placed a single engine of ten horse-power. This is connected, in a massive frame, to countershafts, levers, etc., by means of which its power is distributed to drive the bellows of the chapel division, located near at hand, and also those in the tower division, it being transmitted by means of a strong iron rod having a reciprocal motion, which passes up through the vestibule in the angle behind the circular staircase. In the tower division the motion of this rod is utilized, through another series of levers, to operate the feeders of the main bellows as well as those of a smaller one which supplies high pressure wind to the solo organ and the chime pneumatics overhead. This latter bellows also supplies the echo organ. The magneto machine which generates all the electricity that is required also derives its power from this engine. The great swell and choir wind chests of the chancel division are connected to their respective keyboards by means of trackers, but with this exception the action throughout the entire instrument is either tubular or electric, and were it not for the employment of these systems, particularly the latter, it would have been impossible to have accomplished the task. The whole action of the tower, chancel and echo divisions, both key and draw stop, is electric, and affords eminently satisfactory results. Were all the wires used in making the electrical connections stretched out in one continuous circuit they would extend over a distance of twenty-one miles.

Every portion of the instrument is governed by one performer, and every combined and separate effect can be readily obtained from the four manuals and pedal keyboard placed at his disposal. The couplers are in the form of "on" and "off" pistons placed immediately beneath the claviers which they affect. The manuals have overhanging keys and are brought into the closest possible promixity to each other, rendering the solo keyboard as easy to reach and manipulate as would be the swell in most organs. The draw stops are distributed on either side of the keys at an angle of thirty degrees, and are so arranged that those furthest removed from the organist on each side can be easily reached at the same time. All those belonging to the same department in each divsion affect the one corresponding manual, connection or severance therewith, in divisional groups, being instantaneously effected by means of ventils. In order that these groups and their several departments may be readily distinguished, wood of varied color is used for the background through which each set passes, a method which effectually obviates confusion. Above the pedal keys, in the centre, are placed the two balanced swell pedals, one of which controls the louvres of the chancel and echo divisions, the other those of the tower and chapel sections. The organist can operate both at once, or gradually open one while he closes the other, which produces the effect of the sound decreasing at one end of the cathedral and increasing at the other. Extending to the right of the swell pedals are two rows of small iron ventil pedals, those on the upper row being used for disconnecting the several departments of the tower division, and on the lower performing a similar office in connection with the wind chests of the chancel portion. Perhaps one of the greatest novelties is the electric chime action, by means of which the chimes, consisting of thirteen large bells located in the tower above that division of the organ, are played from the solo manual with perfect ease and convenience. This is the only instance where this has been accomplished. The bells are rung with the same force and precision as though they were struck in the usual manner, and it requires no special expert for the purpose. They can all be rung in connection with the music that is rendered upon the organ.

"Down-Town" Lighting in New York.

The Edison Electric Light Company have begun preparations, says the *Evening Post*, to quadruple the capacity of the down-town station, in Pearl street, near Fulton, by filling the adjoining building on Pearl street with new dynamos. Owing to improvements made by Edison during the last six months, a new plant no larger than that now in the station, which is of six dynamos, will do three times the work. This enlargement has been made necessary by the impossibility of furnishing any more light than the station is now doing. Within the last month sixty applications for the light have been refused, because the dynamos are now working to their full capacity. There are at present 12,000 lamps in the district connected with the station, and an average of 1,400 lights burning all the time, the number rising to 5,000 on dark days and late in the afternoon.

The chief and practically only complaint, according to Mr. Chinnock, the superintendent of the district, is that people burn the light recklessly, and are then surprised that their bills are higher than gas bills. "The public," said Mr. Chinnock, "do not seem to believe that our meters are as accurate as gas-meters; as a fact they are a good deal more so. People imagine that it does not cost us anything to give them light; all that we have to do is to set our engines going, and whether they use more light or less light makes no difference to us; they do not know that every lamp lighted in the district affects us at once in this building. Some time ago we put electric lights into the office of an insurance company with the understanding that the light would cost no more than gas. The president or agent had twice as many electric lights put in as there had been gas lights, and at the end of the first month his bill, to his great astonishment, was double that of his former bills. He came to me to complain. I asked him what he had understood by our agreement to give him as much light for the same money as he had been getting from gas. 'Why,' said he, 'I thought we were to have all the light we wanted.' I asked him if he had thought that he would be able to keep all his lamps going night and day straight along through the month. 'Certainly,' he replied. That is a sample of the understanding some people have of our light. During the last summer we also find that our bills have run ahead of gas bills mainly because people avoid burning gas in summer on account of the heat, but burn our light without inconvenience. Upon the whole, however, our bills are no larger than gas bills when as much care is taken to economize as is taken with gas. Out of 470 consumers, one of them taking as many as 450 lights, we have had but eight persons who ordered the light to be taken out since we began running more than a year ago, and we have had but one case of the kind in the last four months."

Among the new features of the business is a lamp giving a 100-candle light, or about six times that of the ordinary lamp. The average life of the lamp is now about 600 hours of actual use, or about four months, which is considered to be very satisfactory.

The Telephone Consolidation.

Referring to the new consolidation of telephone interests, the Boston *Advertiser* says: The headquarters of the company will be in this city, excellent rooms therefor having already been secured in the Simmons building, at the corner of Water and Congress streets. It is now intended to move from Lowell next week or early the week thereafter, and a cashier only will be left there. The new corporation will be in full working order by Nov. 1, and it purposes, at the earliest possible date, to inaugurate important betterments both in the rates and services of this city and its suburbs. The directory of the company is made up of gentlemen of ample means, and, with the ex-

ception of three members, every one of the nine constituting the board counts his wealth by the millions. Under these circumstances, and with the stockholders of the several companies entering into the combination, perfectly agreeing upon the union, in all the details, the start out is a most auspicious one, and, if all the present indications go for anything, a new era in the telephone business of New England, in which great improvements, not yet generally introduced, will speedily find a place, seems about to be inaugurated. A combination of the character just agreed upon is what ought to have been established long ago, and will unquestionably be mutually beneficial to both corporation and patrons. It is, of course, impossible to tell at what price the new stock will be quoted at when it comes on the market, although, on the basis decided upon, it is certainly worth 80, and may even sell at 90 or thereabouts. One thing at least is sure, that the stock will not go begging, and it would not be surprising if it could not be had by outsiders even at a figure considerably above those named. The Lowell stocks go into the new company, on the basis of Boston & Northern 140, Bay State 120, Suburban 115, National Bell and Maine at 90, and Granite State at 90. There are treasury funds to be divided in some instances. Suburban stockholders will probably get $20 a share, Bay State some $7, and Boston and Northern $5 to $7, not later than April next. The present market price of the shares is about 105 for Boston and Northern, par for Bay State and Suburban, 70 for National Bell, and Granite State unquoted.

The Cummer Engine.

The Cummer Engine Co. furnish the following: "We hand you herewith a letter given to Mr. Cummer by Mr. Walter Laidlaw, which you will observe is a pretty strong indorsement of the 'Cummer' engine. Mr. Laidlaw is a mechanical expert in the employ of the electric light experts to test our engine for them, and not for us. So you see if there had been any fault whatever in regard to the running of the engine, he, instead of being as friendly toward us as his letter indicates, would have been against us, as it was to his interest to pick all the flaws he could with the engine, and to note any changes which might occur in the rate of revolution through varying loads of steam pressures. A test was made with the full load on the engine running the steam down from 90 lbs. to 60 lbs. All the electric light people join in saying that the engine varied less than one revolution. They afterward ran the steam down to 55 lbs.; at this pressure the engine made a variation of one revolution. This was considered a very satisfactory test, and it was the opinion of them all that such close governing had never been obtained before. We were awarded the gold medal, the highest premium given, and also the special premium of $100 offered for the best automatic engine. Our engine running at the Louisville Exposition will be thoroughly tested by the experts there." Mr. Laidlaw's letter is as follows: "Being the juror of the electric light tests who made all the observations on the behavior of your 16x36 inch automatic cut-off engine driving electric light machine during such tests, I am glad to say for your information that I had occasion to take a great many diagrams from your engine, and to note the general performance of your engine as to speed, etc., and I am pleased to say that the behavior of your engine has been all we could desire. We had on several occasions during the tests to throw off a load of 20 H. P. instantaneously, and on as suddenly, and the variation in the speed was only a small fraction of one per cent. The total load on the engine during the tests was 124 H. P., and when the whole load was thrown off the increase in speed was only 2½ per cent."

Produce Exchange Telegraph Lines

The Produce Exchange Telegraph Committee's report, presented by Mr. Theodore Perry, on the 22d inst., states that the difficulties of securing the right of way for a telegraph line to Chicago were so great that an attempt to make estimates of its cost was abandoned. The owners, however, of lines along the New York, Chicago & St. Louis and the New York, West Shore & Buffalo roads, known as the National Telegraph Company, had given the committee the refusal of purchasing the same for $100,000 in bonds bearing 6 per cent. interest, to be issued by a company with a paid-up capital of $100,000. The present owners offer to pay $50,000 to complete the line to its terminal points. As the Produce Exchange is not empowered by its charter to own a telegraph line, the committee proposed that a company with $1,000,000 be organized, the stock to be offered exclusively to members of the New York Exchange and the Chicago Board of Trade to the extent of $600,000 in New York and $400,000 in Chicago, in sums not to exceed $500 to each subscriber. To prevent the consolidation of the proposed line it is recommended that the voting power be placed in the hands of trustees to be appointed by the New York Exchange and the Chicago Board of Trade. A committee of five was recommended to open books of subscription. After opposition to the report by Mr. William M. Burroughs, who believed that there should be first a thorough investigation by experts, and Mr. Partridge, who opposed it on the ground that he did not believe the Produce Exchange should go into the telegraph busines, it was adopted. The question of a new ocean cable was not considered, the projectors not being ready to report.

The project excites some interest in Chicago. President Hobbs, of the Board of Trade there, though of course speaking unofficially, expressed the opinion that such a line would be an excellent thing for the business men. Mr. French, vice-president of the board, denied all knowledge of the proposed scheme, and said he had heard nothing of it. One member of the board stated that the project looked like a scheme to sell a telegraph line, and thought that it was a good way in which to effect such a sale. He believed that the present rates and lines were sufficient for all the commercial business between the two Exchanges.

The Telephone in Iowa and Nebraska.

We learn from the Omaha papers that Mr. Flemon Drake, general manager of the Nebraska Telephone Company, has returned from a trip over Nebraska and Western Iowa, to close up the construction for the year, the line between Fremont and Columbus, which is to be built in November, only excepted.

Since the 1st of August the company has done a vast deal of work. It has put up a second wire between Omaha and Lincoln; built a line from Ashland to Wahoo; a line from Lincoln to Seward, taking in Milford; a line from Lincoln to Crete and Wilber, and a line from Lincoln to Wymore.

In Iowa the company has built from Council Bluffs to Avoca, a distance of forty miles.

The Nebraska company has now altogether 420 miles of lines connecting different cities and towns in that State and in Iowa. Except under the most favorable conditions it will be impracticable to telephone through from Omaha to Des Moines, but the messages will be repeated at Atlantic. It would be possible by building a line through from Omaha to Des Moines without intermediate stations to speak directly, but such a line would not pay.

Omaha is now connected with a system embracing Lincoln, Plattsmouth, Blair, Arlington, Fremont, Elkhorn City, Papillion, Springfield, Louisville, South Bend, Ashland, Wahoo, Greenwood, Waverly, Milford, Seward, Crete, Wilber, Beatrice, Blue Springs, in Nebraska; and Council Bluffs, Weston, Underwood, Neola, Minden, Avoca, Pacific Junction, Glenwood, Malvern, Emerson, Red Oak, Atlantic, Griswold, Hastings, Hillsdale, Malvern, in Iowa. All of these towns named after Avoca are built and controlled by the Nebraska Telephone Company.

The Javan Earthquake.

We are indebted to Mr. Hall, Secretary of the Oriental Telephone Co., London, for the subjoined extract. The narrow strait between Johore and Singapore is crossed by a submarine cable—referred to below. It is about one mile in length, and the whole line 14 miles.

Extract of a letter dated August 30, 1883. *from A. C. M. Weaver, Esq., Singapore:*

No doubt news has reached London of the violent eruption of Mount Krakatow in Sunda Straits, and I thought it might be interesting to inform you of the effect on telephones in Singapore, though nearly 500 miles distant.

Till 3 P. M. on Monday, 27th, conversation was utterly impossible on the Johore line. On raising the tubes a perfect roar as of a waterfall was heard, and by shouting at the top of one's voice the clerk at the other end heard the voice, but of the whole not one single sentence was understood. The same noise but to a less extent was noticed on every line here, and sometimes while listening on the Johore line instruments, a report like a pistol was heard.

A Reward of Merit.

At Anderson, Ind., on the 8th inst., the managers and about 75 employés of the Central Union Telephone Company assembled at the residence of Mr. W. W. Smith, late superintendent of the above-named company, for the purpose of showing to Mr. Smith their appreciation of his many deeds of kindness while acting as their superintendent. The surprise was complete in every particular. Not only were speeches of regret made, but the employés and managers showed their appreciation in a more substantial manner by presenting to Mr. Smith an elegant mahogany bookcase and a chair and desk made of the same material. The occasion was a pleasant one, and one long to be remembered by both Mr. Smith and his old friends. Mr. Smith's impromptu reply was feeling and to the point.

The presentation speech was made by "Uncle" Billy Reynolds, chief operator of the Indianapolis Exchange. The manager and employés were treated to an elegant supper by Mrs. Smith.

Domestic Telegraph & Telephone Co.

The annual meeting of the stockholders of the Domestic Telegraph and Telephone Company was held on the 20th, at Newark, N. J., which is fast becoming one of the leading cities in electrical matters, and as the art advances new developments bring with them the demand for labor. The Domestic Company shows this very plainly. They employ fifty-four persons in constructing and maintaining their lines and operating their business in all its departments, and it has grown to be of importance to the community and to all having use for the telegraph and telephone. The offices of the company are lighted by the Weston incandescent system, supplied from the Mechanic street station. At the meeting directors were elected for the ensuing year as follows: George W. Hubbell, Enos Runyon, Marcus L. Ward, Jr., John D. Harrison, Jabez Fearey, E. Luther Joy, Edward Weston, Frederick T. Fearey and Jacob H. Dawson, Jr.

The Inventors' Convention.

A convention of inventors and other persons interested in inventions was held this week in New York. It appears to have been greatly interrupted by "cranks," but its proceedings are not without interest. The practical outcome is that a memorial was drawn up to Congress in respect to existing wrongs and threatened injustice to a most useful class of citizens. It was petitioned that skilled persons be employed to make a digest of all the matter in the library of the Patent Office, with abbreviations of all inventions, so arranged as to correspond with the classification in the office. It was also asked that the statute which limits the term of a home patent to that of the earliest expiring foreign one be repealed. It was urged that the President should be given power to conclude arrangements for an international union for reciprocal protection and legislation for patents. It was decided that the title of the association should be the American Patent Protective Association, its objects being to foster inventive talent, stimulate inventive genius, facilitate inquiry, and diffuse information. The association proposes to establish bureaus of scientific and legal information, and to promote the introduction of valuable discoveries and improvements. Mr. E. M. Marble, ex-Commissioner of Patents at Washington, was unanimously elected President of the association; Mr. J. A. Price, First Vice-President; Mr. P. H. McNamee, Treasurer, and Mr. F. W. Warner, Recording Secretary. The association then adjourned till Nov. 7.

THE TELEGRAPH.

Cost of Cable Messages.—It costs a good deal to telegraph to distant places. A twelve-word message sent to Vera Cruz from this city the other day, says a Lowell, Mass., paper, cost, with the address, etc., charged for, $16.70.

Heavy Mortgage.—A $3,000,000 mortgage was filed on the 19th ult., in Rensselaer County, N. Y., by the American Rapid Telegraph Company, in favor of the Boston Safe Deposit and Trust Company, for the purpose of enabling the telegraph company to extend their lines south and west.

B. & O. Election.—The annual meeting of the Baltimore and Ohio Telegraph Company was held at Chicago on the 18th, and the following officers were elected: President, George P. Frick; Secretary, G. K. Bruce; Directors, Bradford Dunham, J. Morton Hall and T. H. Dearborn.

Taking its Revenge.—The president of the Western Union Telegraph Company is writing a contribution for the *North American Review*. This is presumably an effort on the part of the odious monopoly to get even with the public on the recent reduction in night rates between Kalamazoo and Oshkosh.—*Chicago News.*

A New Telegraph Soldering-Iron.—A very convenient soldering-iron for the use of linemen in erecting and repairing telegraph or telephone lines has been devised by Mr. J. O. Fry, of the National Telephone Co., Nottingham, England. The bit is hollowed out into a well for receiving a pool of liquid solder, a groove being formed to carry off excess into a chamber within the handle. The joint to be soldered is laid in this well. The iron is so constructed that new bits can readily replace the old, while the flat side of the iron is used in the ordinary way. By its means eight or more joints can be soldered at one time.

A Defunct Telegraph Company Sued.—A bill which is of very direct and pressing interest to over 2,500 persons was filed in the Superior Court, Chicago, on Oct. 16, by Edgar Holmes against the Great Western Telegraph Company and its stockholders, to enforce the stock liability of the latter. The bill sets up that the company was organized Dec. 2, 1867, under the laws of Illinois, for the purpose of carrying on a general telegraphic business, with a capital of $3,000,000, divided into 120,000 shares of $25 each. Its stock was rapidly taken, and it carried on an active business until 1874, when it failed entirely. The first of January, 1875, the lines of the company were leased to the Western Union Telegraph Company, which has ever since had possession of them. Since then the Great Western has never done any business, and in March, 1880, its lines and all other assets were sold and the proceeds applied toward paying a small dividend on the outstanding claims. The complainant asks that an accounting may be had of the debts owing by the company, and that the stockholders may be compelled to contribute such a pro rata sum as may be necessary to pay all claims in full. The total debts of the company are about $300,000, including $150,000 for building the lines, which are now owned by T. S. Sutherland, the attorney for the complainant. If all the stockholders were alive and solvent, a 10-per-cent assessment would be enough, but as many are dead and more are bankrupt, it will probably require an assessment of from 20 to 25 per cent. on the solvent ones to make up this deficiency.

THE TELEPHONE.

NORTHAMPTON, MASS.—A new switch-board has been placed in position at the telephone office, and an additional operator will be employed Monday. There are now 196 subscribers.

A LONG CIRCUIT IN INDIANA.—Telephonic communication has been established between Wabash and Elkhart, Ind., and the line is now complete one hundred miles from Wabash to Lake Michigan.

THE CENTRAL UNION CO., ELKHART, IND.—A list of the subscribers of the Central Union Telephone Co., Elkhart, Ind., shows that Elkhart and Goshen together have over 300 subscribers. J. S. Aldrich is the manager.

THE TELEPHONE IN THE TERRITORIES.—The Rocky Mountain Bell Telephone Company, headquarters in Salt Lake has acquired the sole right to the Territories of Utah, Wyoming, Montana and Idaho, and has eleven exchanges and over 1,000 instruments in successful operation. The capital stock of the company is $800,000, divided into 800 shares of $100 each. It promises to pay good dividends.

THE CENTRAL UNION'S PROGRESS.—This company completed a line from Elkhart to Warsaw, Ind., Oct. 17, and now connects all the important towns in the northern part of Indiana. This fills the gap and makes a continuous telephone line from Lake Michigan to Cincinnati, O. Conversation was carried on from Elkhart to Marion, Ind., a distance of 100 miles, very successfully the day the line was opened.

THE NEW ENGLAND COMPANY.—The certificate of association of the New England telephone and telegraph company has been filed. The capital stock is fixed at $50,000 and a provision made for its increase, but not, however, to exceed $20,000,000. The company's lines are to run from this city through various cities of Massachusetts, Rhode Island, Connecticut, Maine, New Hampshire and Vermont. The corporators are Wm. P. Ingham, Chas. J. Gidden, Loren N. Downs, Wm. H. Bent, Nathaniel W Lillie, Chas. E. Adams, Moses G. Parker, Augustus G. Sanborn and Charles L. Knapp, all of Lowell.

HOW TO PUSH TRADE.—Recently an enterprising firm of drapers in a northern town, says an English trade journal, opened what they called a "Bon Marche," and the students in the Medical School no doubt thought that they might as well apply the "Bon Marche" principle to the purchase of books. Inquiries were instituted, and it was found that this draper's store was supplying nearly the whole of the books, and they had applied themselves so actively to this business as actually to obtain telephonic communication between their "Bon Marche" and the Medical School. Of course here was an important branch of business completely lost to the legitimate bookseller.

THE NEW YORK AMBULANCE SYSTEM.—The plan to extend the ambulance service to greater usefulness than heretofore, which we mentioned last issue, has been elaborated by Superintendent Crowley, of the Police Telegraph, and approved by the Board of Police Commissioners. Headquarters are to be connected by telephone with the Houston and Bleecker street stations on the Third and Sixth avenue elevated roads, and, by order of the company, the telegraph operators along all four lines of elevated road are instructed to give immediate notice to those two points of any accident within their reach or knowledge. There are 109 stations, and thus that number of signal stations are established within telegraphic communication of headquarters at a cost that will not exceed $75—the expense of connecting the stations with the Central Office. This measure effectually disposes of the difficulty met with in the case of accidents occurring far from a police station or a point where communication can be had with a hospital. It will henceforth be possible to call an ambulance from any point in the city within five minutes. The arrangements will be completed immediately.

THE ELECTRIC LIGHT.

WYOMING HEARD FROM.—A 60-inch by 16-foot tubular steam boiler has just been furnished to the Cheyenne Electric Light Company, at Cheyenne, Wyoming.

JABLOCHKOFF CANDLES PAINTED.—Asbestos paint has been used with success in painting the Jablochkoff candles. The arc is much steadier, and the candles last longer.

THE HORSE SHOW.—The electric light continues to be a great attraction at fairs, etc. The Horse Show at Madison Square is illuminated by nearly a hundred electric lights.

PEORIA, ILL.—The Peoria Electric Light Company received its charter from the Secretary of State on Oct. 15, and proposes to have the city lighted with electricity in one month.

THE NEW PRODUCE EXCHANGE.—The latest report of the Building Committee of the grand new Produce Exchange on the Bowling Green, calls for $10,000 for electric lights, and the estimate has been approved.

BOILER MAKING AT HOLYOKE, MASS.—Boiler Maker Coghlan is to introduce the Brush system of electric lights at his extensive establishment on Crescent Street, Holyoke, Mass. He will place 10 lights in the different departments.

NOTHING OLD WILL DO.—Albuquerque, N. M., boasts of being the youngest town in the world lighted with electricity. Albuquerque is an infant of three years which, after twelve months' experience with gas, outgrew that antiquated illuminator and installed the electric light in its streets and public buildings.

ON BOARD THE "OREGON."—Since her arrival at this port, the new Guion steamer "Oregon" has been on view and has been inspected by thousands of visitors. Her electric illumination has been specially admired. She is lighted by the incandescent electric lamp, supplied by the Edison Company, a separate switch being supplied for each stateroom.

LOWELL, MASS.—The committee on lighting has voted to place the following additional electric lights: Corner of Dutton and Fletcher streets; junction of Market and Salem streets, near Adams; Franklin square; corner of Appleton and Thorndike streets; corner of Central and Union streets; Hosford square, and two on Middle street. The globes have been removed from the lamp-posts in those streets where the electric light has been introduced.

ELECTRIC LIGHTING IN PITTSBURGH.—The Allegheny County Light Company was formed in September, 1882. Officers of the company are H. H. Westinghouse, president; J. E. Ridall, vice-president and business manager; John Cadwell, treasurer; R. D. McGonigle, secretary; S. A. Duncan, superintendent. The company controls the Brush patents for Allegheny County. It is now running 300 lights from the central station, and 1,100 in various mills and factories in the county.

THE MERCHANTS' STATION IN BOSTON.—The Merchants' Electric Light and Power Company has leased of Messrs. Henry Poor & Son the estate numbered 197, 199, 201 and 203 on Congress street, specially adapted for the purpose of an electric lighting station. Into the basement will be put boilers aggregating 1,000 horse-power in capacity, and 20 Armington & Sims engines of 50 horse-power each while on the floor above will stand 40 dynamo machines of a capacity of 25 lights each. The electric light company takes possession at once.

LIGHTING BY THE SAWYER-MAN SYSTEM.—The contract for lighting the new building of the Mutual Life Insurance Company on Nassau street has been awarded to the Sawyer-Man Illuminating Company, which is the licensee in this city of the Consolidated Electric Light Company. The "plant" for supplying the light will consist of 1,500 standard 16-candle lamps and 10 Sawyer lamps of 125-candle power each, the latter to be used for lighting large indoor spaces. This apparatus will be the largest "isolated lighting plant" in the city. The steam power for operating it will be obtained from the pipes of the New York Steam Company.

IN BUFFALO, N. Y.—The territory lighted by electricity is about to be extended by the addition of nearly eleven miles of new line. On Monday, said the *Express* of the 20th, if everything progresses satisfactorily, the following east-side streets will be lighted: Seneca Street to Babcock, a part of Fulton Street, Louisiana to Van Rensselaer, Mackinaw from Louisiana to Catherine, Alabama from Scott to South, Elk Street as far as ordered, and Abbott Road from Elk Street to the Buffalo Creek. The west-side additions will be ready about the last of the month. This will add much to the appearance of the city at night and will be a great convenience.

HELL GATE BRIGHTENED.—The sections of the tower for the electric light to be established on Hallett's Point, Hell Gate, East River, were finished last week by the Cooper Manufacturing Company, of Mount Vernon, Ohio, and were accepted and paid for by the Lighthouse Board. They will reach the Lighthouse Depot, Staten Island, in the course of the week. The tower is of angle iron, 250 feet high, and is constructed like the observatory at Coney Island, of which it will be almost a counterpart—that is, a skeleton structure of four pillars, with stays, braces and girders, each pillar being set into solid concrete blocks ten feet square. Each face will be fifty-four feet between pillars. The cost will be about $10,000.

WHY THE LIGHT WENT OUT.—The Edison electric lights in the First District of this city went out on the stormy night of the 23d inst. Major S. B. Eaton, president of the Edison company, subsequently gave the reason for the occurrence as follows: "It was," he said, "caused by the extraordinary large load of lights, due to the dark and rainy day. The load burned out the lead in the safety catches used throughout the underground conductors to guard against fire, and the lamps went out. New safety catches in the leads are now being inserted, and as as soon as that can be done all the lamps will burn again usual. Hereafter larger leads will be used, and a similar accident will not occur again."

GAS CROWDED OUT.—A scientific commission is to pass on the question whether the manufacturers of gas in Paris cannot supply their illuminant cheaper. The report cannot fail to be of wide interest the world over. The probability is that it will be against the company and in favor of the citizens, from what every chemist knows of the commercial value of the incidental products of the industry. From the progress making in the manufacture of appliances for producing, distributing, and using electricity, gas, as a source of light, appears to be doomed. But the production of gas may go on, nevertheless, and on a large scale. If electricity is to give humanity light in the future, gas may take the place of coal in heating houses and for cooking purposes.

THE "FULLER" SERVICE FOR MEADVILLE, PA.—The Fuller bid for lighting Meadville, Pa., with 50 arc lights as offered to the City Council was $11,664.00 and was based upon the following estimate:

One "Phœnix" 75 horse-power engine and boiler, complete with smokestack,	$2,184.00
Insulated copper wire put up on poles ready for use	2,000.00
Poles for all purposes	1,100.00
Iron wire	60.00
Shafting, belting and pulleys	320.00
	$5,664.00
Electrical machinery	$6,000.00
	$11,664.00

As the motion finally passed to have 80 arc lights, one 30 light dynamo and 30 all-night lamps must be added at a cost of $3,000, which mades the total sum $14,664. All lights are of standard 2,000 candle-power, and the above estimate is exclusive of ground, buildings and foundations for machinery.

MISCELLANEOUS NOTES.

The Electric Mfg. & Miscellaneous Stock Exchange of N. Y., Limited, are now listing and prepared to receive all Electrical Stock for listing on their Board at their new Exchange, No. 11 Pine street, corner Nassau.

ACCOUNTING FOR IT.—A stroke of lightning knocked the local editor of the Sumpterville *Times* out of his chair while writing locals in his sanctum. This accounts for the excellence of his paper this week.—*Palatka (Fla.) Journal.*

A NATURAL ELECTRICIAN.—Mr. W. W. Cowley, who manufactures agricultural and similar implements at Stamford, Delaware County, N. Y., is what might be called an electrician by nature. Although kept very busy, he is an inveterate inventor, having produced and patented several interesting electrical devices.

TO DECOMPOSE WATER.—Mr. C. C. R. suggests in a contemporary the use of wind-wheels to drive dynamo-electric machines to decompose water. He would store the resulting gases in suitable holders, and use when desired for lighting purposes, or for heating, or for any employment for which such gases may be available.

ADVANTAGES OF THE ELECTRIC FURNACE.—Two advantages are possessed by the electric furnace, and it is difficult to underestimate them. The temperature which can be produced is limited only by the refractory nature of the crucible, and the heat is developed first in the substances to be melted without traversing what contains them.

THE PROBABLE CAUSE OF EARTHQUAKES.—M. J. Delauny still holds to his theory on the probable cause of earthquakes in spite of the objections of M. Faye. He lays down his views in the following proposition. "Most cosmic and terrestrial meteorological phenomena, and especially the great seismic disturbances, seem to occur when the great planets pass through certain longitudes, notably those of 135° and 265° or thereabouts."

ELECTRICAL FLANNEL FOR RHEUMATISM.—*La Nature* describes an electric curiosity invented by a Dr. Claudet. A flannel to cure or alleviate rheumatism is the article. It contains, per kilo, 115 grams of the oxides of tin, copper, zinc and iron. A series of threads of this fabric are impregnated with these metallic products, and each series is alternately separated by raw threads. The flannel thus prepared constitutes a true dry pile. It is said to develop electricity by simple contact with the body, or better still, with the products of perspiration.

GRAPE CULTURE.—Signor Macagno has experimented near Palermo upon the influence of atmospheric electricity on the growth of grape vines. Sixteen plants were submitted to the action of an electric current, by means of a copper wire inserted by a platinum point in the extremity of a fruit-bearing branch while another wire connected the branch at its origin with the soil. The experiment lasted from April to September. The wood of the branches experimented upon was found to contain less potash and other mineral matters than the rest of the vine, but the leaves had an excess of potash in the form of bitartrate. The grapes collected from the electrized branches furnished more mast, contained more glucose, and were less acid on the other hand.

THE "ROARER" BOREALIS.—The assertion that audible sounds are sometimes produced by the aurora borealis is not a new one, but the evidence supporting it has not been entirely satisfactory. The testimony of a careful observer is now added. Captain Dawson, commander of the British circumpolar expedition at Fort Rae, reports that while his party was traveling northward from Winnipeg an aurora was observed—evidently very near—which was accompanied by a distinct swishing noise like that of a sharp squall in a ship's rigging, or that made by a whip in passing through the air. He is led to believe that the sound is heard occasionally, through rarely, but that it would be more frequently noticed were it not that the aurora is generally at too great a height.

SCIENTIFIC HANGING.—It has also been mooted recently whether some more scientific process might not yet be adopted with advantage. The chemist and the electrician have tremendous agencies at their disposal, one or other of which might be utilized for the destruction of the criminal. ut poor humanity is already too sorely beset by murder;

ous enemies, and legislators may well pause before they permit the development of the means of taking life. Great practical difficulties, too, would probably supervene in giving effect to any new process, whether by poison or electricity. The intervention of some skilled agent would be indispensable; the fatal poison must be administered scientifically; the dread forces of electricity must be set in motion by some expert, and it might not be easy to persuade doctors or servants to act as executioners. But a still stronger objection exists to this or any kind of change in the manner of carrying out the penalty of death. It is not likely that any such change would easily secure legislative sanction, not from any positive dislike to accept this or that new method, but because the opening of the question at all would end in the abolition of capital punishment altogether. Whether society can quite afford to part with one of its greatest safeguards is beyond the scope of this paper to discuss. But all who feel that the law which exacts a life for a life is our best and perhaps our only protection against the growth of homicide will prefer to leave our system of execution unchanged. An imperfect process is better than none at all, and it will be better to adopt reasonable improvements than bring about abolition by vain search after an impossible ideal.—*The Fortnightly Review.*

The James-Hueston Cable.—"It is reported," says the *N. Y. Herald*, "that the James-Hueston cable will land on Long Island. We consider this a mistake. The distance from Europe is too great, and the cable will be greatly in danger from the fishing fleets. All the cables now laid by the present cable ring saved this extra three hundred miles cost by running into Cape Ann, Cape Cod and some into Halifax. This is our opinion and we give it for what it is worth." To the above, Mr. J. C. Hueston publishes the following reply:

"The *Herald*, commenting on a published report that the cables of the new company of which Gen. James is President are to be landed on Long Island, thinks such a course would be unwise because of the greater length and of increased risk of interference by fishing vessels. The company has made no authoritative announcement of its intention in this matter; but with improved cables and methods of working, 300 extra miles in the main line would not be of much importance, while the whole number of miles from New York to London by such a direct route would be fewer instead of greater than by Newfoundland or Nova Scotia. There would not be so many repetitions as on the old route, and messages would be proportionately expedited. The increased danger from interference by fishing vessels is even less apparent, since the fishing grounds lie far to the northward of the line such a cable would follow. That the existing cables do not enjoy immunity from such interference is shown by the frequent interruptions to which they are subject, three of which during the month of 'August last, I am informed, were attributed to fishermen. The direct cable, which lands in Nova Scotia, was cut three times before it was a year old."

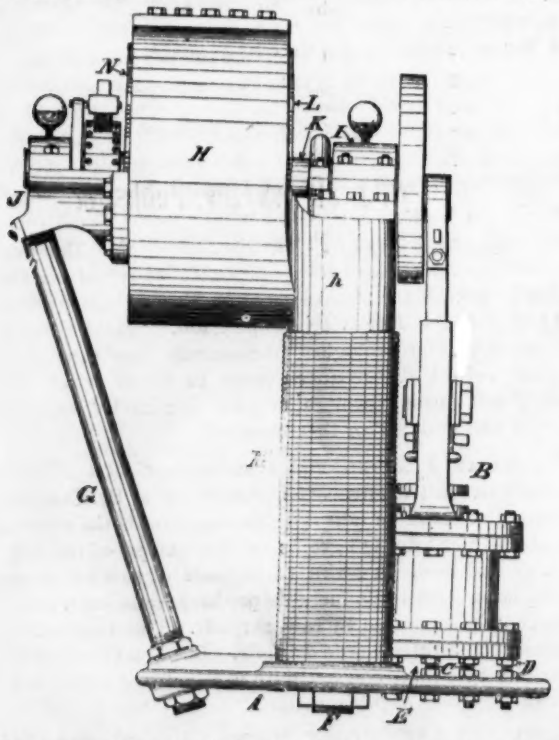
Stock Quotations.—Telegraph, telephone and electric light stocks were quoted on Friday of last week and Friday of this week as follows:

	Oct. 19.	Oct. 26.
American Cable	60	62½
Western Union Telegraph	75⅝	79⅝
Bankers and Merchants' Tel.	134¼	135¼
Commercial Telegram	100	....
Mutual Union Telegraph	....	16½
American District Telegraph	16	16
Postal Telegraph	....	45
American Bell Telephone	204	209
Shaw Telephone	30	....
Bay State Telephone	101	104
Globe Telephone	....	40
Long Island and New Jersey Telephone	....	90
Mexican Telephone Co.	2	2⅛
National Bell Telephone of Maine	71	69
New York and Pennsylvania	90	88
Boston & Northern Telephone	106	90
Overland Telephone	15	....
Suburban	100	100
Erie Telephone	50½	50
Granite State Telephone	85	85
New York and New Jersey	94	94
Daft Electric	112	....
Brush Electric Light	90	90
Edison Electric Illuminating	....	80
Edison Electric Light	75	...
U. S. Electric Lighting	120	117
American Electric Light	9	....
Electric Railway of United States	70	....

"ELECTRICAL WORLD'S" ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

All the patents mentioned below are dated October 16, 1883.

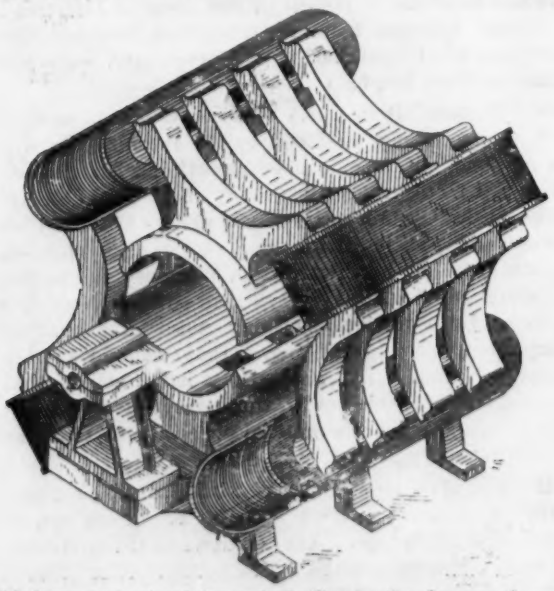
Apparatus for counterbalancing disturbance in telephones; A. Bernstein, Boston, Mass. 286,577
Apparatus for controlling electric currents; Maurice Lévy, Paris, France. 286,833 and 286,834
Combined steam-engine and electric generator; L. G. Woolley, Dayton, O. 286,985



Two wrought-iron vertical posts *F* are secured to the bed-plate *A*, and form the field magnet, to the polar extremities of which are secured pole pieces *H*. The bed-plate supports the engine cylinder, and the engine shaft is supported by pillow-blocks, one of which is secured to the poles of the magnet, while the other is supported by an inclined column resting on the base plate. The armature is secured to and carried by the engine shaft.

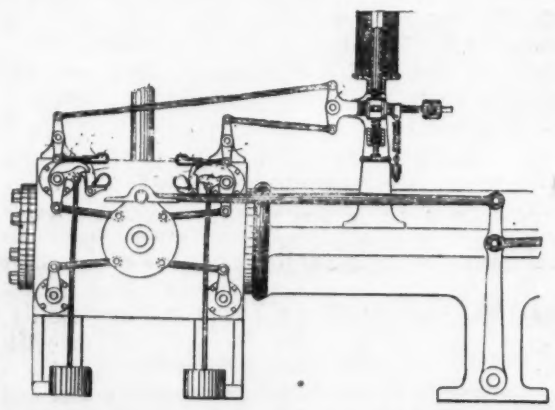
This arrangement of the parts secures great compactness, and at the same time solidity.

Dynamo-electric machine; Edwin J. Houston, of Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of New Britain, Conn. 286,612



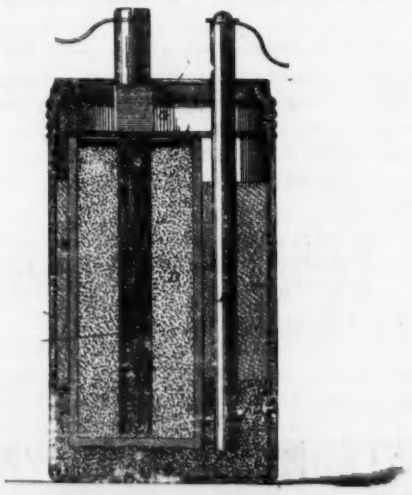
This improvement relates principally to the form and construction of the field-magnet frame and the armature core or carrier. Our engraving shows the arrangement of the field-magnets and connecting bars forming an octagonal magnet-frame. This disposition of the parts secures a number of advantages: First, the massive character of the pole pieces insures uniformity and strength in the magnetic field; second, the openings between the several parts admit of a free circulation of air throughout the machine; third, the position of the magnet coil relative to the pole pieces and the armature, the coils being parallel with and in close proximity to the revolving wire on the armature, results in strengthening the current, and finally, this form secures great compactness.

Conduit for electric wires and devices pertaining to electrical conductors; J. F. Martin, Chicago, Ill. 286,937 to 286,950 inclusive
Combined annunciator and alarm system; E. A. Sperry, Cortland, N. Y. 286,970
Double-Current Relay; A. C. Fraser, Brooklyn, N. Y. 286,917
Electric-arc Lamp; D. C. Hans, T. E. Mc Namara, and J. S. Zerbe, Cincinnati, O.; assignors to the American Union Electric Company of the same place. 286,925
Electro-Magnetic Alarm; A. Wisneall, Cincinnati, O., assignor to F. Vollckel, same place. 286,888
Electric Motor, S. F. Van Choate, Boston, Mass. 286,873
Electrical Low-Water Alarm; J. E. Blake and Chas. A. Hell, N. Y. City. 286,581
Electric Governor; E. B. Parkhurst of Woburn, assignor to himself and A. L. Parcelle of Boston, Mass. 286,841



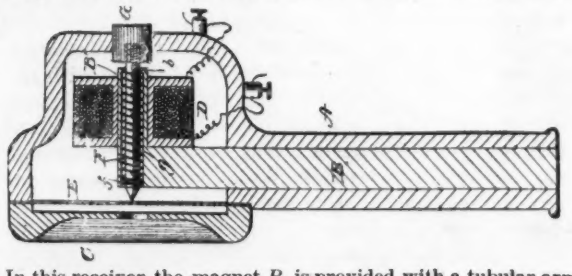
This is a governor for steam engines used in driving dynamos. It is arranged so that the supply of steam to the engine will be controlled or varied by the action of the current. The inventor proposes two methods of controlling the engine, one consisting in operating a throttle-valve by means of an axial magnet in the main or derived circuit, the other consisting in regulating the cut-off mechanism by the same means. Our engraving shows the apparatus applied to the cut-off mechanism of a Corliss engine.

Galvanic-Battery. Alfred Haid, of Rahway, N. J. 286,809



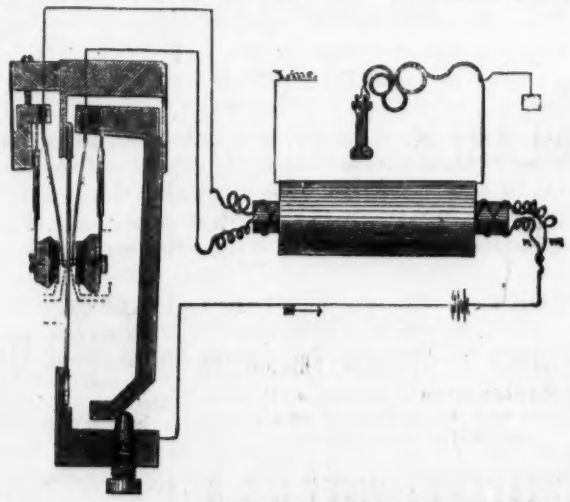
The negative electrode in this battery consists of a carbon conductor *E*, surrounded by a depolarizer formed of mercuric oxide and carbon. The positive electrode is zinc, and the exciting fluid is a solution of salammoniac. This battery is said to be very constant and to have a high electromotive force.

Incandescent electric lamp; D. G. Fitzgerald, Brixton, County of Surrey, England. 286,916
Insulator; Bradley A. Fiske and Samuel D. Mott, New York City. 286,801
Insulating wrapper for grouped electrical conductors; J. H. Kohnescher, Cincinnati, O. 286,829
Process of making electrical conductors; Thos. Egleston, New York City, assignor to Plume & Atwood Mfg. Co., Thomaston, Conn. 286,796
Printing-Telegraph; Henry Van Hoevenburgh, Elizabeth, N. J., assignor to Western Union Telegraph Co., New York City. 286,977
Printing-Telegraph; A. Wirsching, Brooklyn, N. Y. 286,667
Receiver for Telephones; Henry E. Waite, New York City. 285,875
Telegraph-Relay; Mr. J. O. Sullivan, Baltimore, Md., assignor of three-fourths to J. F. Morrison, same place. 286,955
Telegraphic Cable; Wm. T. Henley, Plaistow, County of Essex, England; George Henley and Sydney Gedge, executors of said Henley, deceased. 286,698
Thermometric Electric Circuit Closer; Morris Martin, Malden, Mass. 286,722
Telephone; Geo. R. Shipherd, Hartford, assignor of one half to W. E Simonds, Canton, Conn. 286,737
Telephone-receiver; Henry E. Waite, of New York City. 286,876



In this receiver the magnet *B* is provided with a tubular arm *B* surrounded by the coil *D*, and containing a pin *F* of non-magnetic material. The point of this pin is held in contact with the centre of the diaphragm *E* by a spring *g*, and the opposite end of the pin carries an armature *G*. As the armature *G* is acted on by the magnet, its motion is transmitted to the diaphragm through the non-magnetic pin.

Telephone Exchange system, G. F. Durant, St. Louis, Mo. 286,595
Voltaic-Arc Lamp, C. A. Moses, N. Y. City. 286,953
Telephone Transmitter; Chas. D. Haskins, of New York City, assignor to the Western Electric Company, Chicago. 286,923



Heretofore the current of the local telephonic circuit has been sent through the primary of the induction coil in one direction or as an alternating current, the primary consisting of a single wire. The present improvement consists in winding the primary of the induction-coil in branches arranged so that the current will divide and pass in opposite directions through the primary, the two pairs of contact-points of the transmitter being oppositely arranged so that when the diaphragm is set in vibration the current in the branches of the primary will vary, inducing reversed currents in the line passing through the secondary of the induction-coil.

All Persons Sending for Catalogues or ordering articles advertised in our columns will do us and our Advertisers both a great favor by mentioning that they saw the advertisement in

The Electrical World.

CAT-HEAD CARDS.—Lovely set, 4 designs. Mailed on receipt of 5c. HEARNE & CO, Box 1487. N. Y

Pride, Fraleigh & Kyle Telegraph Engineers Electricians and Contractors, 23 and 25 Dey Street, New York.

EVERYTHING

Relating to ELECTRICITY for sale, and Electrical work done. J. F. FAIRMAN, Cooper Union, N. Y

Telegraph and Electrical SUPPLIES

Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue C. E. JONES & BRO. Cincinnati, O.
It is important to us that you mention this paper.

Bell Telephone Stocks

Bought and sold by J. O. SHIRAS, No. 11 West Third Street, Cincinnati, O.
MONEY LOANED ON TELEPHONE STOCKS.

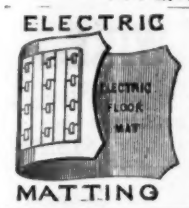
CONSULTING CHEMIST AND ELECTRICIAN.—Analysis of all commercial and technical products. Investigations made on all questions bearing on electricity. Full information and prices mailed free on application. JAMES H. STEBBINS, JR., S. B., F. C. S., 117 Pearl St., New York.

SHORT-HAND

Writing thoroughly taught by mail. Terms low; satisfaction guaranteed. Send stamp for circular and specimen of writing.
W. W. HULTON, Stenographer, Pittsburgh, Pa.

BOSTON AND SANDWICH GLASS CO.

OFFICE AND SAMPLE ROOMS,
No. 17 MURRAY ST., N. Y.
REPRESENTED BY
C. F. L. BRINKERHOFF.



THE N. Y. APPLEGATE Electric Matting Co.

Invisible Electric Alarm Matting Appliances. Send for circular. Office, Mills Building, 35 Wall Street, New York.

PLATINUM.

JOHN H. MUEGGE,
MANUFACTURER OF ALL KINDS OF
Crucibles and Vessels. Plate, Wire, Foil and Sponge.
Scraps purchased.
No. 91 Liberty Street, New York.

J. L. LAZELLE & CO.

MANUFACTURERS OF THE BEST AND CHEAPEST
ELECTRIC IRON BOX & SKELETON BELLS, MEDICAL BATTERIES, ELECTRODES, BUZZARS, ETC.
Experimental work and Electrical Supplies of all kinds a specialty.
48 Centre St., New York.

The Suffolk Electric Mfg. Co.,

28 SUDBURY ST., BOSTON,
MANUFACTURERS OF
Electric Bells, Striking Gongs, Annunciators, Burglar Alarms, Push Buttons, Switches, Keys, Spark Coils, Batteries, Electric Gas Lighting, and Specialties of all kinds.

NEARLY READY.

ELECTRICITY
IN
THEORY AND PRACTICE,
OR
The Elements of Electrical Engineering.
A Clear Explanation of the scientific principles and the practical applications of Electricity.
BY
Lieut. BRADLEY A. FISKE, U. S. N.
8vo, Cloth, 180 Illustrations.
D. VAN NOSTRAND, Publisher,
23 Murray & 27 Warren Sts., New York.
Complete Catalogue of Electrical Books will be sent to any address on application.

ON TRIAL French Battery for the cure of Rheumatism, Neuralgia and Nervousness. Send for circular.
C. E. JONES & BRO. Cincinnati, Ohio.
It is important to us that you mention this paper.

WHITE CEDAR
TELEGRAPH and TELEPHONE
POLES AND CROSS ARMS.

We are prepared to furnish White Cedar Poles and Pine and Spruce Cross Arms, all lengths and sizes, and in any quantity, delivered on cars or at any point in New England at short notice.
Contracts taken for the building and equipping of telegraph and telephone lines anywhere in New England.
Correspondence solicited.
BARNES & SNOW,
P. O. Box 493. BANGOR, ME.

TELEGRAPH AND TELEPHONE POLES.

65,000 25 to 60 feet. No. 1 Quality.
These Poles are Live Timber, well seasoned, and in every way desirable. Deliverable on line of F. & P. M., Mack. Div. M. C., P. O. & Pt. Austin Railroads.
Electric Light, Railroad, Telegraph and Telephone Companies supplied. Prompt delivery.
HENRY C. RIPLEY,
EAST SAGINAW, MICH.

CEDAR TELEGRAPH POLES.

LIGHT POLES FOR TELEPHONE LINES AND LONG POLES FOR CITY USE CONSTANTLY ON HAND.
50,000 Split Cedar Posts on Hand Ready for Immediate Delivery.
BROWNLEE & CO.,
Detroit, Mich.

ALFRED F. MOORE,

MANUFACTURER OF
Insulated Wire
FOR
Telephone, Telegraph and Electric Light,
OFFICE, LINE,
AND
ANNUNCIATOR WIRE,
Magnet Wire and Flexible Cordage,
200 & 202 N. THIRD STREET,
PHILADELPHIA, PA.

PALMER WIRE CO.,

PALMER, MASS.

TELEGRAPH
AND
TELEPHONE
WIRE,

As Good as the best. Special care taken in its manufacture.
Write us for prices before ordering elsewhere.

THE ANSONIA BRASS & COPPER CO.,

MANUFACTURERS OF

Pure Electric Copper Wire,
For Magnets, Telephones, Electric Lights, Etc.
With H. Splitdorf's Patented Liquid Insulation, covered with Cotton or Silk.
LINE WIRE.
Fire-Proof House and Office Wire for Indoor Use in Electric Lighting.
Wrought Metal Gongs, for Annunciators, Telephones, Etc. Zinc Rods, Battery Copper, Etc.
NOS. 19 & 21 CLIFF STREET, NEW YORK.

EDSON'S SPEED AND PRESSURE
RECORDING GAUGE AND ALARM.
Vibrating Gong and Batteries, to be placed in Engine Room.
EDSON'S STANDARD GAUGES
are alike adapted for steam, high and low pressure, water, oil and gas in reservoirs, pipes, etc., and are indispensable to safety and economy.
THE ALARM GONG,
by ringing at the boiler, prevents explosion and saves both life and property. The speed of DYNAMO MACHINES must be uniform, and these chart records are the best checks against irregular speed, placing responsibility where it belongs.
For descriptive illustration see No. 28 ELECTRICAL WORLD. For pamphlet and prices address

The Edson Recording and Alarm Gauge Co., No. 77 Liberty Street, N. Y.

FIX & HERRMANN,

169 and 170 FULTON STREET, New York.
MANUFACTURERS OF

District Telegraph Specialties

To all the Different District Telegraph Companies.
Double Pen Registers, Call Boxes, Electric Bells, Batteries and Annunciators, Electric Lamps
Independent Wire Local Burglar Alarm Apparatus, and every description of
ELECTRICAL INSTRUMENTS AND APPLIANCES.
Strictly first-class in quality, at prices
MUCH LOWER THAN THEY CAN BE PURCHASED FOR ANYWHERE ELSE.
ESTIMATES PROMPTLY FURNISHED.

JUST PUBLISHED.
Fully Illustrated. Price, $3.00.
PHILIP REIS:
Inventor of the Telephone.
A Biographical Sketch, with documentary testimony, translations of the original papers of the Inventor and contemporary publications. By SILVANUS P. THOMPSON.
Catalogue of Electrical Books free on application
E. & F. N. SPON,
35 MURRAY STREET, NEW YORK.

READY SHORTLY.
ELECTRICITY, MAGNETISM AND ELECTRO-TELEGRAPHY.
A Practical Guide for Students, Operators and Inspectors, by
THOMAS D. LOCKWOOD,
With 158 Illustrations.
D. VAN NOSTRAND,
Publisher, 23 Murray and 27 Warren Sts., N. Y.
Complete Catalogue of Electrical Works will be sent to any address on application.

JUST PUBLISHED.
ELECTRICITY
AS A
MOTIVE POWER.
BY
Count Th. Du Moncel.
316 Pages and 113 Diagrams and Illustrations.
Sent post-paid on Receipt of Price, $3.00.
The above book, or any book published, can be had by addressing
W. J. JOHNSTON, Publisher,
No. 9 Murray Street, New York.

PLACE IT IN YOUR SAFE.
Invest $8 for $10,000 Accident Policy with $50 Weekly Indemnity in the
United States Mutual Accident Association.
320 and 322 Broadway, N. Y.
and place it in your safe. Twenty-five dollars a year will carry this insurance, and should misfortune overtake you in the way of fatal or disabling injury, there will never be cause to regret your forethought and prudence. European permits without extra charge.

All Kinds of Apparatus for Elementary Study of Electrical Science.

A SCIENTIFIC NOVELTY—The Student's Electrical Cabinet — Designed to accompany CURT W. MEYER'S "Elementary Guide in Electricity." The apparatus will illustrate the heating power of electricity by igniting gas, ether, alcohol, firing electric cannon, etc.; will electrify any number of persons joining hands, and will also illustrate most of the phenomena of electric attraction, repulsion and induction. A brilliant spark, *one* inch, can be produced, showing the electric light in *vacuo*, and illustrating the principles of lightning. The apparatus will furnish the student ample means to perform any known experiment of this most amusing science. Complete Apparatus, $15, including Electrical Machine.
CURT W. MEYER, 11 Dey St., N. Y.

HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

FIREPROOF INSULATED ELECTRIC LIGHT WIRE

From Pure Lake Superior Copper. Conductivity Guaranteed.

Patent "K. K." Insulated Copper and Iron Wire, for Telephone and Telegraph Use.

49 CHAMBERS ST., N. Y. WORKS: WATERBURY, CONN. 18 FEDERAL ST., BOSTON.

ON TRIAL French Battery for the cure of Rheumatism, Neuralgia and Nervousness. Send for circular.
C. E. JONES & BRO. Cincinnati, Ohio.
It is important to us that you mention this paper.

ENGLISH
Patent Office.

H. GARDNER,
166 Fleet St., London.

Successor to
Messrs. Robertson, Brooman & Co.

Gives prompt personal attention, and obtains Patents for Inventions, Protection for Trade Marks, etc., at fixed and moderate charges. Pamphlet of costs gratis.

Thirty years' practical experience.

Provisional Protection, £8

THE KERNER STYLOGRAPHIC PEN.

$1.00. **$1.00.**

THE LATEST IMPROVEMENT IN STYLOGRAPHIC PENS.

The flexible air tube attached to the needle extension gives a soft and delicate touch to the pen and a vibratory motion which keeps the ink in a constant state of agitation while writing and causing a perfect flow to the point. Our $1.00 pen equal to the best. The difference in price depends alone upon the ornamentation. **Our No. 5 RULING PEN is the BEST IN THE WORLD for Book-keepers.** A perfect line always assured. No blurring or blotting. Price $1.50. Other styles according to mounting, $1.25, $1.50 and $3.00. Ask your stationer for them, or send to

THE KERNER STYLOGRAPHIC PEN COMPANY, 25 Bond Street, New York.

Short-Hand Writing thoroughly taught by mail. Good situations procured all pupils when thoroughly competent. First-class stenographers furnished railroad officials without charge for my services. Correspondence solicited. Caligraphs sold. Special inducements offered operators and railroad officers. Send for COLLEGE REPORTER and caligraph circulars to W. G. CHAFFEE, Oswego, N. Y.

GEORGE WESTINGHOUSE, Jr., President. ROBERT PITCAIRN, Treasurer.
C. H. JACKSON, Vice President and General Manager. ASAPH T. ROWAND, Secretary.
HENRY SNYDER, General Agent.

THE UNION SWITCH AND SIGNAL CO.,

PITTSBURGH, PENNA.,

A CONSOLIDATION OF

THE UNION ELECTRIC SIGNAL CO., Of Boston, Mass. AND OF THE INTERLOCKING SWITCH & SIGNAL CO. Of Harrisburg, Pa.

SOLE OWNERS AND MANUFACTURERS OF THE ONLY PRACTICALLY SUCCESSFUL SYSTEM OF

OPERATING RAILROAD SIGNALS AUTOMATICALLY

ALSO OF

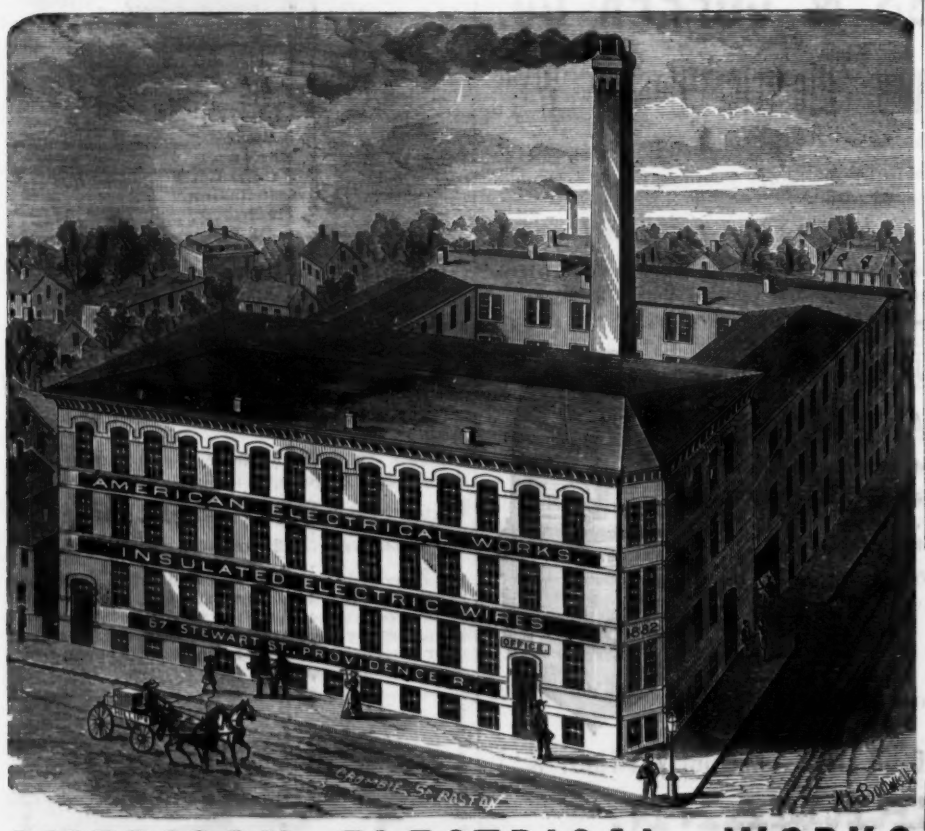
APPARATUS FOR OPERATING AND INTERLOCKING SWITCHES, SIGNALS AND GATES BY LEVERS, HYDRAULICS, PNEUMATICS OR ELECTRICITY.

ALSO MANUFACTURERS OF

FROGS, CROSSINGS, SWITCHES AND SWITCH STANDS.

☞ Plans, estimates and detailed descriptions, together with references to apparatus in practical operation, will be furnished upon application.

Office and Works, Corner Fayette Street, Garrison Alley and Duquesne Way.



AMERICAN ELECTRICAL WORKS

(Formerly EUGENE F. PHILLIPS),

MANUFACTURERS OF

PATENT FINISHED

INSULATED ELECTRIC WIRES, TELEPHONE AND ELECTRIC CORDAGE, ELECTRIC LIGHT WIRE.

Magnet Wire, Patent Rubber-Covered Wire, Burglar Alarm and Annunciator Wire, Lead-Encased Wire; Anti-Induction Aerial and Underground Cables, etc., etc.

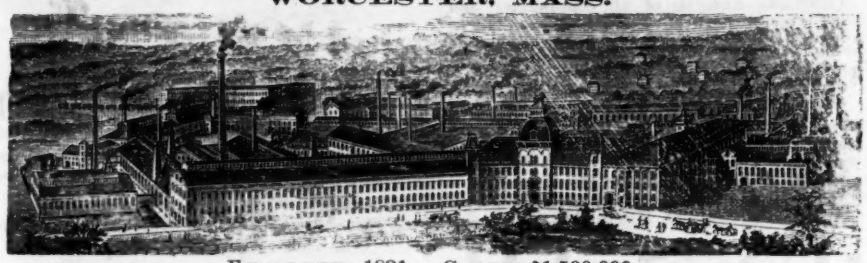
Office and Factory, 67 Stewart Street, Providence, R. I.

EUGENE F. PHILLIPS, President. W. H. SAWYER, Secretary and Electrician.

TELEGRAPH WIRE. TELEPHONE WIRE.

WASHBURN & MOEN MANUFACTURING COMPANY

WORCESTER, MASS.



ESTABLISHED 1831. CAPITAL $1,500,000.

16 Cliff and 241 Pearl Street, New York.
215 Lake Street, Chicago.

This Company having given careful attention to Telegraph Wire from the introduction of the Art of Telegraphy, and especially with reference to the conditions necessary to *highest electric conductivity*, does not hesitate to recommend this class of its products as unequaled in that particular. Being the first to

MAKE A SPECIALTY OF TELEGRAPH WIRE

and anticipating at an early day the great demand that would exist for that article, they well adopted and fully proved certain methods and appliances for the production of Telegraph as have as of Telephone Wire which are peculiar to themselves. Among them may be mentioned the

PATENT CONTINUOUS ROLLING MILL, PATENT CONTINUOUS GALVANIZING BATH, AND THE BELGIAN ROLLING MILL.

(In connection with the DOUBLE SIEMENS FURNACE).

All Wire made by this Company for Telegraph or Telephone purposes is thoroughly tested before shipping, with regard to Conductivity, Tensile and Torsion strength, as well as Elongation.

Prices and terms for Telegraph or Telephone Wire—Plain, Oiled or Galvanized—given upon application.

N. B.—The qualities known as extra Best (E. B. B.) and Best Best (B. B.) kept constantly in stock

---

JEROME REDDING & CO.,

30 HANOVER ST., BOSTON, MASS.,

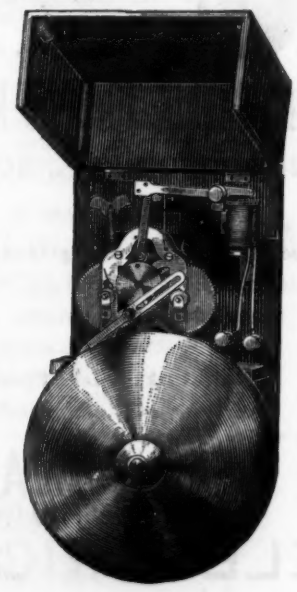
MANUFACTURERS OF

ELECTRIC BELLS, ANNUNCIATORS, BURGLAR ALARMS,

Gas-Lighting Apparatus, Improved Lelanche Batteries, Improved Frictional Battery and Burners for Lighting Gas in Halls and Theatres, and all other Electrical Supplies.

THE HOTEL ANNUNCIATOR,

"Jerome Redding & Co.'s Annunciator, in use in this house, gives perfect satisfactoin, and I think they furnish an ideal Annunciator." W. L. SHEPARD,
Proprietor Bay State House, Worcester, Mass.
July 11, 1883.



THE ELECTRO-MECHANICAL OR STRIKING GONG.

This Gong is operated by a spring, strikes three hundred blows at one winding, is absolutely certain in operation, requires but little battery power, and is sold at a very low price.

RUBBER PIPING OR TAPE.

The best in use for wrapping the joints of electric light and other wires. The only tape which will fit snugly and make a waterproof joint. Sold at a very low price. Sample sent by mail.

PUSH BUTTONS

Of latest design, nicely polished, made of all varieties of wood, at exceptionally low prices, with large discounts for large orders.

Send stamp for our new illustrated catalogue, containing much useful information in regard to Electric Bells, Annunciators and Gas Lighting Apparatus, with full instructions for putting up and maintaining them, and diagrams showing how to run the wires. Address

JEROME REDDING & CO.,

30 HANOVER ST., BOSTON MASS.

SPIRAL

TELEPHONE

WIRE.

Patents allowed April 20 and July 2, 1883.

UNLIMITED DISTANCE TELEPHONY!

CLEAR ARTICULATION

Over Long and Short Lines!

Long line wires may be tested at the offices of this company, in comparison with ordinary wires on the same poles of the American Bell Telephone Company.

The Patents on the Spiral Wire were only granted after absolute comparative tests at Washington.

TELEPHONE COMPANIES

And Others Having Bad Service Wires

Can Arrange for Perfect Service.

No. 13 spiral wire weighs only 110 lbs. to the mile.

FOR ALL DISTANCES,

Instantaneous Reproduction Without Exertion.

Address Orders for wire to

American Spiral

Telephone Wire

Company.,

43 MILK STREET,

BOSTON MASS.

ON TRIAL

French Battery for the cure of Rheumatism, Neuralgia and Nervousness. Send for circular.

C. E. JONES & BRO. Cincinnati, Ohio.

It is important to us that you mention this paper.

NEW FOOT LATHES

For Electricians

Send stamp for circular to

Narragansett Machine Co.,

PROVIDENCE, R. I.

ELECTRICITY!

EVERY FAMILY SHOULD HAVE ONE OF

DR. JEROME KIDDER'S

Electro-Medical Apparatuses.

THEY ARE THE BEST, owing to the Simplicity of Operation, Durable Construction and Physiological Qualities of Electricity they produce.

DISEASES CONQUERED!

THE ENEMY ROUTED!

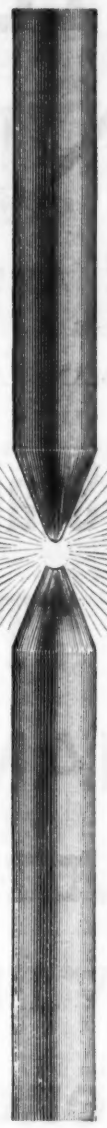
Why suffer from the effects of Rheumatism, Gout, Neuralgia, Paralysis, Dyspepsia and Nervous Diseases, when you can procure the only positive eradicator of diseases and promotor of health?

Our superior Electro-Medical Apparatuses *have stood the test, and are pronounced invaluable as remedial agents.*

The public should be on their guard against the many so-called Electric Belts, Bands, Armadillos, Brushes and Garments, as they are made to deceive the public, and not for their so called Electric Currents.

To distinguish the genuine from the spurious, send for a copy of the "Electro-Allotropic Physiology," mailed free. Address JEROME KIDDER MANUFACTURING CO., 820 Broadway, New York City.

Boulton Carbons.



These carbons are made of the best materials, and with the latest improved machinery, of any required degree of hardness, and can be used in all makes of Electric Lamps. The regular sizes, 12 inches long, run from ¼ inch to 1 inch in diameter, varying by sixteenths. Special lengths and sizes to order. A large and complete stock always on hand. The want of a high order of battery plate has long been felt. Those wishing such would do well to use the Boulton Plates. Special attention is given to the manufacture of all sizes to order. Price-Lists and full information furnished on application.

BOULTON CARBON WORKS,

990 Payne Avenue, Cleveland, O.

PHOSPHOR-BRONZE TELEPHONE WIRE.

The STRONGEST, TOUGHEST and BEST for line wires of electric and acoustic telephones. Will not STRETCH nor RUST. RESISTS SMOKE. ACIDS and DAMPNESS. TENACITY more than FOUR times its weight per mile.

PHOSPHOR-BRONZE RODS, SPRING METAL AND WIRE,

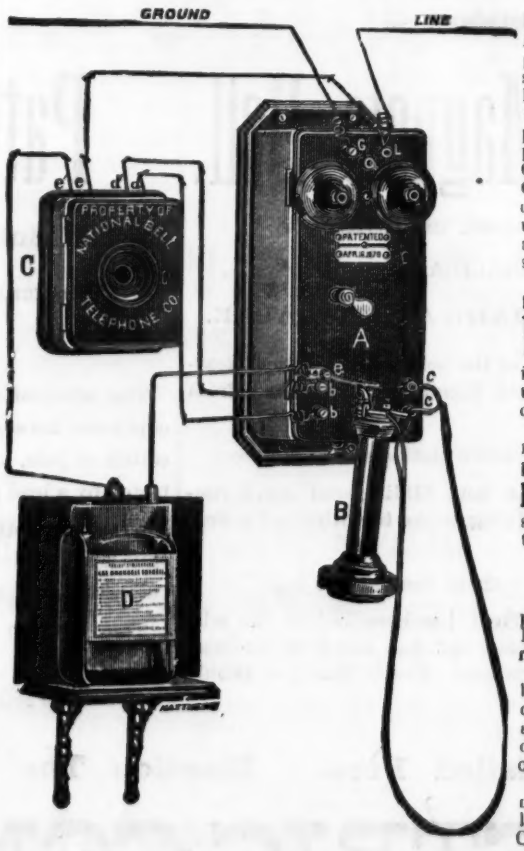
superior to German silver or brass for electrical apparatus. Already extensively used throughout the country. Address

THE PHOSPHOR-BRONZE SMELTING CO., LIMITED
512 ARCH ST., PHILADELPHIA, PA.

Owners of the U. S. Phosphor-Bronze Patents. Sole Manufacturers of Phosphor-Bronze in the United States.

THE AMERICAN BELL TELEPHONE COMPANY.

W. H FORBES, President. W. R. DRIVER, Treasurer. THEO. N. VAIL, General Manager.



This Company, owning the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents covering improvements upon the same, and controlling, except for certain limited territory, under an arrangement with the Western Union Telegraph Company, the Gold and Stock Telegraph Company, the American Speaking Telephone Company, and the Harmonic Telegraph Company, the patents owned by those companies, is now prepared to furnish, upon application, either directly or through any of its agents, Telephones of different styles, and applicable to a variety of uses.

This company desires to arrange with persons of responsibility for establishing

District or Exchange Systems,

in all unoccupied territory, similar to those now in operation in all the principal cities in this country.

Responsible and energetic persons are required to act as licensees for the purpose of establishing

PRIVATE LINE AND CLUB LINE

systems, for business or social uses. Also to introduce the telephone for

SPEAKING TUBE

purposes, for which instruments will be leased for a term of years at a nominal rental.

This Company will arrange for telephone lines between cities and towns where Exchange systems already exist, in order to afford facilities for personal communication between subscribers or customers of such systems.

We respectfully invite attention to this matter, and any further information relating thereto can be obtained from the Company,

No. 95 Milk Street, Boston, Mass.

All persons using Telephones not licensed by this Company are hereby respectfully notified that they are liable to prosecution, and for damages for infringement, and will be prosecuted accordingly to the full extent of the law.

VIADUCT

Manufacturing Co.

OF

BALTIMORE CITY.

WORKS:

RELAY STATION, B. & O. R.R.

OFFICE:

CHAMBER OF COMMERCE,

ROOMS 29 AND 31.

This company, in connection with its present affairs, will continue the business of the late firm of

DAVIS & WATTS,

to which it has succeeded, the latter firm having dissolved, and Mr. Augustus G. Davis, its senior member, having assumed its entire assets and liabilities.

Mr. Davis has transferred to this company (of which he is president)

All Interests of Whatever Nature

Heretofore pertaining to Davis & Watts, and will henceforth give his personal supervision to the manufacture of electrical goods of every description.

Having increased facilities and ample capital, we will carry a large stock of

TELEPHONE, TELEGRAPH

ELECTRIC LIGHT,

and American district supplies of all kinds.

Our works are on the Patapsco River, at the Relay Station, B. & O. R. R, with an abundance of water power.

We carry continually a large stock of

CROSS-ARMS,

PINS,

BRACKETS,

INSULATORS,

AND WIRE

(both line, office and electric light), and our prices will be found most reasonable.

We solicit a continuation of the favors heretofore extended by customers to the late firm of Davis & Watts, in the assurance that we can and will make it to their advantage.

We have in preparation

A New Illustrated Catalogue

which, when ready, we shall be pleased to furnish.

VIADUCT MANUFACTURING CO.,

A. G. DAVIS, President.

WESTERN ELECTRIC COMPANY'S

TELEPHONIC SPECIALTIES.

LICENSED BY THE AMERICAN BELL TELEPHONE COMPANY.

MANUFACTURES AND FURNISHES

The Western Electric Standard and Multiple Switch-Boards.

THE TOLL STATION SWITCH-BOARD.

THE WILLIAMS SWITCH-BOARD.

THE NEW GILLILAND MAGNETO BELL.

THE WILLIAMS BELL.

Pole Changers, Generators, Lightning Arresters, Extension Bell Switches.

CABLES FOR USE UNDERGROUND, OVERHEAD AND UNDER WATER.

INSULATED WIRE, TELEPHONE CORDS, LINE WIRE AND SUPPLIES.

BATTERIES AND APPARATUS FOR ELECTRICAL MEASUREMENT.

Multiple Switch-Boards.

MANUFACTURED UNDER THE PATENTS OF

L. B. FIRMAN, C. E. SCRIBNER,
C. H. WILSON, and C. C. HASKINS,
M. G. KELLOGG.

Our Multiple Switch-Board is in use in :

Baltimore,	London (England),	New Orleans,
Columbus,	Melbourne (Australia),	Peoria,
Dayton,	Memphis,	Toledo,
Indianapolis,	Milwaukee,	Washington.
Kansas City,	Minneapolis,	
Liverpool (England),	Nashville,	

No other Board so happily combines the three requisites of **Speed, Simplicity and Economy.**

Its use does away with the **repeating of orders,** either by word of mouth or by tickets.

One operator does all the work necessary in connecting and disconnecting two subscribers on both lines, and does it instantly without moving more than a step.

Gilliland Magneto Bell.

MANUFACTURED UNDER THE PATENTS OF

E. T. GILLILAND.

STRONG, WELL MADE AND DURABLE.

The revolving armature of the bells has Hard Steel Bearings, and the wire is Held Firmly and Protected from oil.

The Driving Gear has Positive Motion and is Noiseless.

The Telephone Switch has both Sliding and Anvil contacts, and is made extra strong so as to withstand severe use.

The Ringer is adjusted without opening the box.

The **New Gilliland Bell** has been before the telephonic public for over a year, and has met with the most pronounced favor everywhere. Every Manager should try it.

Patterson Cable.

Aerial, Subterranean and Submarine.

MANUFACTURED UNDER THE PATENTS OF

W. R. PATTERSON.

The wires of which these now well-known cables are composed are separately covered with several windings of cotton or jute, or both, saturated with paraffine and protected by a lead pipe.

The Insulation is of the highest possible degree and thus is a guarantee of the Permanence and Durability of the cable.

They contain in themselves no causes of change or deterioration.

Over 2,600 miles of conductors are in successful use.

Illustrated Catalogues and Price-Lists Mailed Free. Mention The Electrical World.

WESTERN ELECTRIC COMPANY,

CHICAGO. NEW YORK. BOSTON.

CHARLES WILLIAMS, JR.,

109 to 115 Court St.,

BOSTON, - - - MASS.

MANUFACTURER OF

Telegraph, Telephone, and Electrical Instruments of all kinds.

MANUFACTURER OF

THE WELL-KNOWN

WILLIAMS CENTRAL OFFICE Telephone Switch-Board.

The best and most reliable as well as the most convenient system for Exchanges of any number of subscribers.

Switch-Boards of 25 or 50 lines in sets of any desired number for any capacity.

ALSO MANUFACTURER OF

MAGNETO BELLS

and subscribers' outfits of all kinds and descriptions, with Push Buttons or Magneto Generators having Automatic cut-outs, in various styles of finish, ncluding Ebony, Birds-eye Maple, Cherry, Walnut, Ash, etc., with ornamentation to any desired extent, suitable for Cabinets, Parlors, etc.

EXTENSION BELLS

with Swiss, sleigh, cow-bells, or spherical ringers. Small, compact.

HAND AND POWER GENERATORS

capable of ringing bells through lines of 20,000 ohms resistance. For use in Central Offices or other purposes.

ALSO MANUFACTURER OF

EVERY DESCRIPTION OF TELEGRAPH INSTRUMENTS,

KEYS, RELAYS, SOUNDERS, ETC.

A complete line of House and Hotel Annunciators and Burglar Alarms, with all the latest improvements.

TELEPHONE, TELEGRAPH AND ELECTRIC LIGHT SUPPLIES,

LINE WIRE, INSULATED WIRE,

Batteries in Full Assortment,

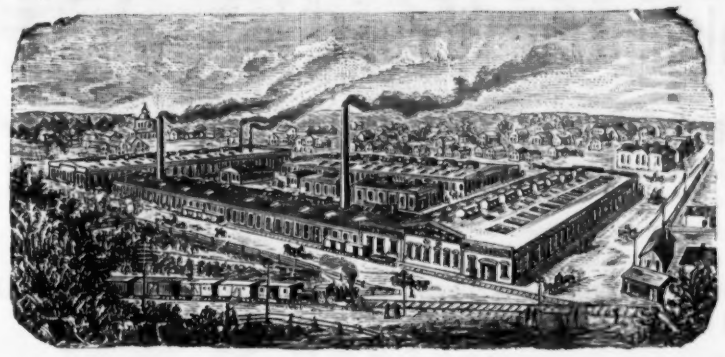
and everything else used by those engaged in Electrical Pursuits, of the best quality and at the lowest ruling prices.

Send for circulars and mention THE ELECTRICAL WORLD.

CHARLES WILLIAMS, JR.,

109 to 115 COURT STREET, BOSTON, MASS.

ARC LIGHTS.



WE DESIRE TO CALL ATTENTION TO THE

BRUSH MACHINES

We are now manufacturing, intended to give lights of about two-thirds of the power of our usual size of arc lights. They are fully equal to the ordinary size lights of other systems, and except in the amount of light are the same in every respect as our other lights.

Number of Machine.	Number of Arc Lights.	Nominal Candle Power.	Horse-Power required.
5	10	1,200	6
6	20	1,200	11
7	30	1,200	15
8	64	1,200	35

Prices of our machines and lamps the same as our regular list. Our agents will give estimates We shall commence this month the shipment of

BRUSH STORAGE BATTERIES

To fill the large orders which have accumulated on our books. We desire to state that these batteries are

GUARANTEED

By this Company, just as all the apparatus hitherto sold by us has been; and that the statements of our opponents regarding them, which have been so industriously circulated of late, are false in every particular.

THE BRUSH ELECTRIC CO.,

No. 379 Euclid Avenue,

CLEVELAND - - OHIO.

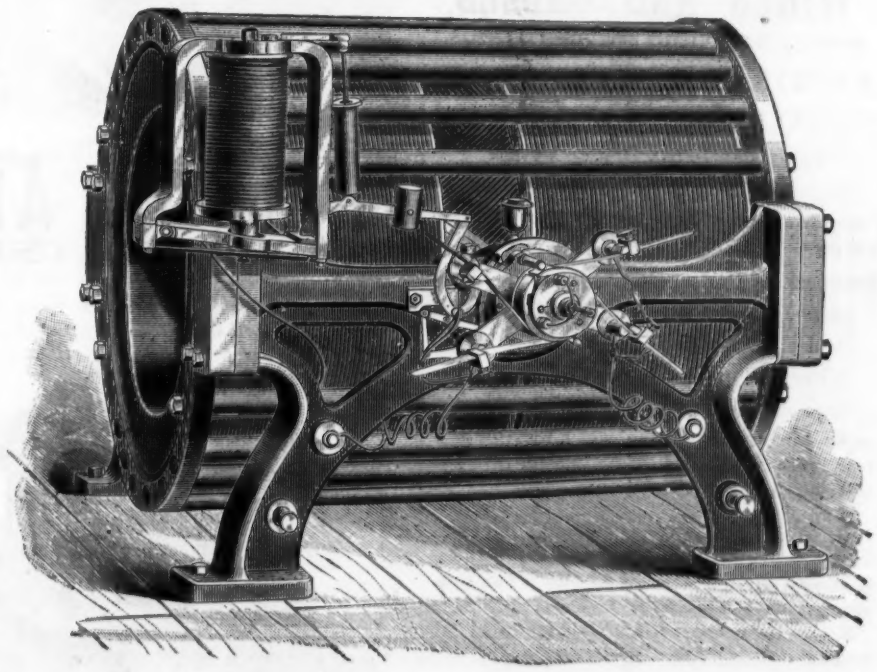
May 12, 1883.

THE

Thomson-Houston Electric Co.

FURNISHES THE

ONLY PERFECT, AUTOMATIC, SELF-REGULATING SYSTEM OF ELECTRIC ARC-LIGHTING IN THE WORLD.



In all desirable qualities of Electric Arc Lights the **THOMSON-HOUSTON SYSTEM** has no equal. The lights are superior in color and steadiness, and the entire apparatus is more economical, efficient and safe, more easily managed, and less liable to derangement than any other.

The Thomson-Houston Electric Co. has been awarded the First Prizes for

The Best System of Arc Lighting and the Best Arc Lamp

at the Industrial Exposition in Cincinnati.

Principal Office, 131 Devonshire St., Boston, Mass.

New Illustrated Pamphlet will be sent on application.

Telegraph and Electrical SUPPLIES

Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue **C. E. JONES & BRO. Cincinnati, O.**

It is important to us that you mention this paper.

Gelatinized Fibre.

(Trade Mark.)

The New Substitute for Hard Rubber.

Adopted by the leading Electric Light Companies and Manufacturers of Electrical Apparatus, being a better non-conductor, lighter and more durable, at half the cost.

Send for samples, circulars and prices to

COURTENAY & TRULL,

No. 15 Dey St., New York.

THE BUTLER HARD RUBBER CO.

Electrical Supplies,

33 Mercer St., New York.

Manufacturers of

Sheet Rubber, Rods, Tubing, Etc.,

RUBBER HOOK INSULATORS.

Key Knobs, Switch Handles, Magnet Covers, Magnet Heads, Window Tubes, with Heads, Battery Cells, Battery Syringes, And Specialties of any Required Character.

J. H. LONGSTREET,

No. 9 Barclay Street,

NEW YORK,

MANUFACTURER AND DEALER IN

TELEGRAPH INSTRUMENTS,

Telephone and Telegraph Supplies OF EVERY DESCRIPTION, ANNUNCIATORS AND BURGLAR ALARM APPARATUS, BATTERIES AND BATTERY MATERIAL.

Telegraph Instruments for Railroad Use a Specialty.

DAY'S

KERITE INSULATED

Telegraph, Telephone and Electric Light

WIRES AND CABLES,

MANUFACTURED ONLY BY THE INVENTOR,

AUSTIN GOODYEAR DAY,

OFFICE: 120 BROADWAY, NEW YORK.

FACTORY: SEYMOUR, CONN.

KERITE INSULATION should be used on electrical conductors for any of the following purposes:

Submarine, Underground or Aerial Telegraph, Telephone and Electric Light Cables; Office Cables and Lines; also for Battery, Burglar Alarm, Fire Alarm, Police and Submarine Blasting Purposes,

or for any other operation which requires perfect, indestructible and permanent insulation of electric wires.

A large number of

ANTI-INDUCTION KERITE TELEPHONE CABLES, some of them TWO MILES IN LENGTH, are in use in several cities, and are found to WORK PERFECTLY for that distance.

Kerite is recommended and indorsed by all leading men connected with telegraphy, telephony, and electric lighting.

At the CENTENNIAL EXHIBITION at Philadelphia, Sir WILLIAM THOMSON, the eminent Electrician and Scientist, awarded to the

Kerite Insulated Wire and Cables

A DIPLOMA

For "Excellence of the Insulation and Durability of the Insulator."

For Sale by all Dealers in Telegraphic Materials.

CLARK B. HOTCHKISS, Gen. Agt.

120 Broadway, New York.

The Works of the JNO. A. ROEBLING SONS CO., at Trenton, N. J., have facilities for producing large quantities Telegraph Wire on short notice. The Belgian system of rolling long lengths wire rods, and improved methods of galvanizing, were first introduced in the United States at these works. It insures the production of wire with few joints and with a thick coating of zinc.

JOHN A. ROEBLING SONS CO.

MANUFACTURERS OF

TELEPHONE AND TELEGRAPH WIRE

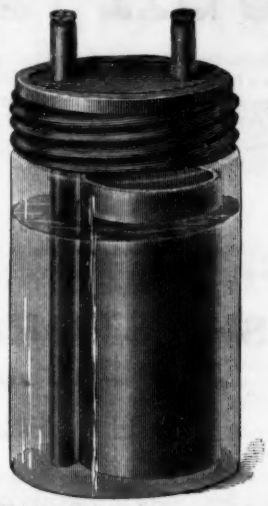
WORKS AT TRENTON, N.J.

ALL KINDS WITH THE HIGHEST ELECTRICAL CONDUCTIVITY

OFFICE & WAREHOUSE 117 & 119 LIBERTY ST. NEW YORK.

THE BERGMANN & HAID BATTERY.

THE GREATEST OPEN-CIRCUIT BATTERY IN THE WORLD!



Height, 6¼ inches.
Dia meter, 3¼ inches.

BERGMANN & CO.

Have now succeeded in supplying what has till now been the GREAT DESIDERATUM in Telephone and all open circuit work. This Battery is not only

The Simplest, Cleanest, Most Economical and Most Durable of All,

but it overcomes all the existing defects of the Leclanché and other forms hitherto employed.

It is Small, Neat, Compact and very Portable, Hermetically Sealed, and Guaranteed to form no Gases. On this account it requires hardly any attention.

IT WILL LAST MORE THAN TWICE AS LONG as any other. IT IS CHEAPER than any other.

PRICE CHANGED TO $1.20, COMPLETE.

Samples sent to dealers and telephone exchanges on application. Send for circular. Liberal Discounts to dealers.

BERGMANN & CO.,

ELECTRICAL WORKS,

292 to 298 Avenue B. corner Seventeenth Street, New York.

"Prism Battery" Complete.

LECLANCHÉ "Prism" BATTERY

—THE—

GREAT TELEPHONE BATTERY,

THE STANDARD OPEN CIRCUIT BATTERY OF THE WORLD!

None are Genuine without the Trade Mark **PILE-LECLANCHÉ** on Prisms, Carbon Head, Jar and Cover.

ADOPTED BY ALL THE TELEPHONE COMPANIES.

Over 500,000 cells now in use in the United States and 1,000,000 in Europe.

Beware of Infringements and Cheap Imitations.

Price Reduced to $1.65 Per Cell. Special Discounts for Quantities of 100 Cells and upward,

THE LECLANCHÉ BATTERY CO.,

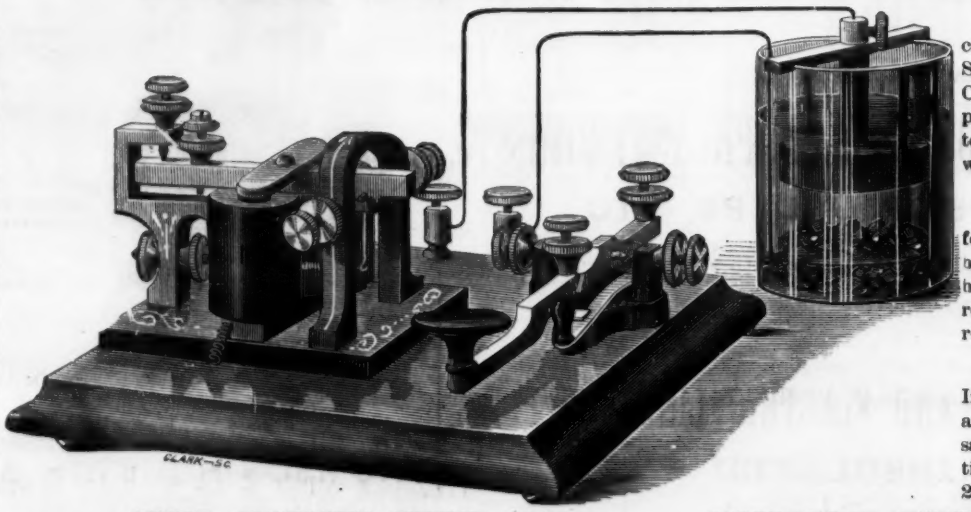
149 WEST 18th STREET, NEW YORK.

Or, L. G. TILLOTSON & CO., General Agents,

5 & 7 Dey Street, New York.

PREMIUM APPARATUS. ONLY $5.00.

NOT THE CHEAPEST, BUT GUARANTEED THE BEST.



The PREMIUM APPARATUS AND OUTFIT comprises the famous "NEW GIANT SOUNDER PERFECTED," and the "NEW CURVED KEY," placed upon a splendidly polished base, with a cell of Callaud Battery, Chemicals, Office Wire, etc., for $5, when the money accompanies the order.

These instruments are the exact size and form of those upon which we received the highest award at the late Centennial Exhibition over all competitors. Everything reliable, and so guaranteed, or money refunded.

Since the introduction of the "Premium Instruments we have sold thousands of them, and in every instance they have given entire satisfaction, whether used for home practice or for actual work on lines from 1 to 20 miles in length.

PRICE, COMPLETE OUTFIT, $5.00. INSTRUMENT WITHOUT BATTERY, $4.20.

Instrument wound with finer wires for lines of one to 15 miles, **$5.00**; Cell of Battery, Complete, **80** cents: Premium Sounder, Separate Base **$2.50**; Premium Key, Separate Base, **$1.75**; Premium Apparatus, Key and Sounder entirely Nickel plated without battery, **$5.20** Complete Nickel-plated Instrument, with battery and outfit, **$6.00**; Sounder, Separate Base, **$3.25**; Key, **$2.00. Money in advance.**

Instruments without battery, sent by mail, 55 cents extra. Battery jars cannot be sent by mail. All orders will receive our prompt and careful attention. To prevent delay in shipment, full shipping instructions with town, county and State should be given. Remittances should be made by P. O. money order, registered letter, draft or express, which will insure safe delivery. Send for catalogues and circulars before purchasing elsewhere.

PARTRICK & CARTER,

(ESTABLISHED 1867).

MANUFACTURERS OF TELEGRAPH INSTRUMENTS AND SUPPLIES,

No. 114 South Second Street, Philadelphia.

Standard Electrical Works,

Authorized Agents and Manufacturers of The American Bell Telephone Company's Bells, Switch-Boards, etc.

SOLE MANUFACTURERS OF

THE CELEBRATED POST MAGNETO BELL,

WHICH WE CLAIM TO BE

THE FINEST BELL IN THE WORLD.

MANUFACTURERS OF AND DEALERS IN

TELEGRAPH, TELEPHONE AND ELECTRIC LIGHT WIRE AND SUPPLIES.

AGENTS FOR

Roebling's Galvanized Line Wire.

REASONS WHY OUR BELLS ARE THE BEST:

FIRST,

Because we make the cylinder of our generator, containing the magnets, of **solid brass and iron cast together** (our patent way). By this we are enabled to get the cylinder perfectly true, and are able to set the magnets out very close to the metal, thereby **increasing the strength** and **decreasing friction,** and preventing dust or dirt from getting in.

SECOND,

Our **New Cut Wheel Gear,** nearly noiseless, will give better satisfaction than any way heretofore tried. The **friction** slips; the **plain rubber** band wears away; we make the gear of small teeth, both cut the **same way;** that largely does away with the noise; very positive in its action, and we provide for any wear by adjustment.

THIRD.

We have **less soldered connections** to get loose or out of order than any other bell made. The bell is so arranged that it can be opened, exposing all connections, without cutting out the bell—very important for quick and thorough inspection. All the vital connections have **rubbing contacts** and are **set upright,** thereby preventing dirt from remaining on them.

OUR IMPROVED SWITCH-BOARD

HAS NO SUPERIOR ANYWHERE.

We use no Cords, depending entirely upon Rubbing Contacts.

WE ALSO MANUFACTURE

LIGHTNING ARRESTERS, POWER GENERATORS, COMBINATION BELLS,

And all the et ceteras needed by a Telephone Exchange.

OUR EXTRA TERRITORIAL BELL

IS GUARANTEED TO RING THROUGH

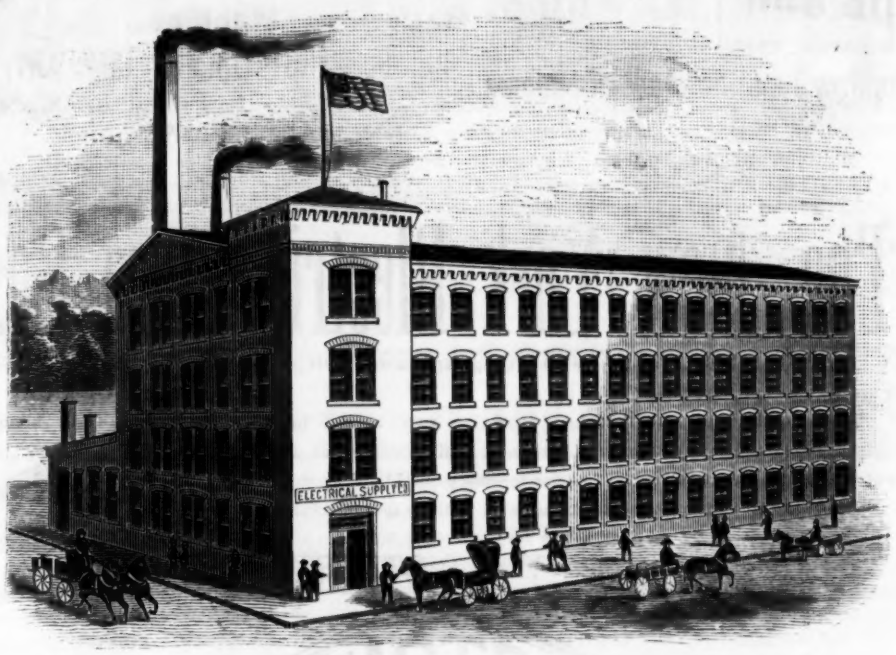
20,000 OHMS RESISTANCE.

Send for Catalogue and Price-List and Mention "The Electrical World."

STANDARD ELECTRICAL WORKS,

CINCINNATI, OHIO.

THE ELECTRICAL SUPPLY CO.



Factory of the Electrical Supply Company at Ansonia, Conn.

MANUFACTURERS OF AND DEALERS IN ALL KINDS OF

Telegraph, Telephone and Electrical Instruments Apparatus and Supplies.

SOLE MANUFACTURERS OF THE

"DIAMOND" CARBON BATTERY.

This Battery, as perfected and improved, is Unequaled for Telephone or Bell Work.

It has more than Double the Carbon Surface

of any other Battery, and is unsurpassed for

Efficiency, Constancy and Simplicity.

Jar, 6 inches High, 4 inches Square. Fits any Telephone Box

PATENTS ALLOWED, AUG. 1, 1883.

Least Internal Resistance.

Greatest Electromotive Force.

Greatest Power of Recuperation.

Cheapest Single Parts to Renew, Most Satisfactory and Substantial in Every Respect.

PRICE, COMPLETE, $1.25.

PRICE OF PARTS:

Jar only	each 15 cents.	Plain Zincs	10 cents.
Jar Top only	" 15 "	Zinc Connector	05 "
Carbon Ring (connector)	10 "	Mercury Cup	10 "
Each short Carbon	08 "	Sal ammoniac	08 "
Long Carbon and connector	30 "		

Discount—Per case, 10 per cent.; for 10 cases, 20 per cent; for 25 cases, 30 per cent.

Packed in cases of 1 dozen each, or in bulk. (Fifty Batteries complete.) Dozen cases will be arged 35c. each.

WE ALSO MANUFACTURE A FULL LINE OF

Insulated Wires and Cables for all Electrical Purposes.

Telegraph Keys, Sounders, Relays, Switches, Batteries, Etc.

HOUSE AND HOTEL ANNUNCIATORS AND BELLS.

SOLE AGENTS IN THE UNITED STATES FOR

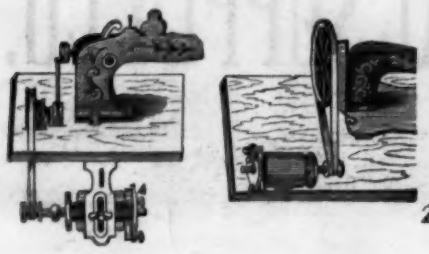
Frederick Smith & Co.'s High Grade Galvanized Iron Telegraph and Telephone Wire.

FROM STOCK IN NEW YORK OR TO IMPORT.

Circulars and Price Lists mailed free. Correspondence solicited. Mention THE ELECTRICAL WORLD.

ELECTRICAL SUPPLY COMPANY,

No. 17 DEY STREET, NEW YORK.



Motors, Dynamos, Automatic Batteries.

The Only Practical Electric Motors for Family Sewing Machines.

THE ELECTRO-DYNAMIC COMPANY,
224 Carter Street, Philadelphia, Pa.
SEND STAMP FOR CIRCULAR.

The New York Electric Lines Co.

Manufacture and furnish aerial Telegraph and Telephone Cables absolutely free from troubles of induction.

These cables have the advantage that they may be laid underground at any time should legislation compel such a course. Estimates and cables of all sizes, lead inclosed or plain, for underground construction furnished for territory outside of New York.

Advanced scientific principles are applied in these manufactures.
Full explanations given on application.

OFFICES, 37 & 39 WALL STREET, NEW YORK.

TJKeech MgrTelEx Warrant WO

ARMINGTON & SIMS ENGINE COMPANY
TRADE MARK
PROVIDENCE, R.I. U-S-A

Utica Fire Alarm Telegraph Co.

MANUFACTURERS OF

TELEPHONE EXCHANGE

SWITCH-BOARDS,

TELEPHONE AND TELEGRAPH

INSTRUMENTS & SUPPLIES

HOUSE, HOTEL AND BURGLAR ALARM ANNUNCIATORS,

Bells and Push Buttons.

Every Description of Electrical Apparatus in Stock.

PALMER'S

Universal Telephone Switch - Boards,

WITH PALMER'S PATENT SPRING JACKS, AND IMPROVED OPERATORS LOOPING-IN-KEY.

The following are some of the Exchanges using this system:

Albany, N. Y.	Clinton, N. Y.	Amsterdam, N. Y.	Galveston, Tex.
Troy, N. Y.	Herkimer, N. Y.	West Troy, N. Y.	Houston, Tex.
Cleveland, O.	Little Falls, N. Y.	Cohoes, N. Y.	Little Rock, Ark.
Utica, N. Y.	Gloversville, N. Y.	Lansingburg, N. Y.	Canadian Exch'ges.

Mexican Tel. Co. Tropical American Tel. Co., and many others.

THE AHEARN

PATENT LIGHTNING ARRESTER.

"THE ARRESTER THAT ARRESTS."

MANUFACTORY AND OFFICE,

106, 107 and 108 LIBERTY STREET, UTICA, N. Y.

CHARLES A. ROLFE, General Agent.

FLEISCHMANN'S ELECTRIC BELL OUTFIT.

Complete, $2,50, with full Directions.

"RAPID" TELEGRAPH APPARATUS.
Complete, $3.75 with Battery, etc.
Send for Circulars.

A. F. FLEISCHMANN'S ELECTRIC WORKS,
1226 Chestnut St., Philadelphia, Pa.

The Only One-Man Car Made.

The Patent Velocipede Hand Car.

Used on more than 150 Railroads.

Large Numbers Exported.

Runs Easily, is Durable and Capable of High Speed. Circulars and indorsements of prominent railroads sent on application.

SHEFFIELD VELOCIPEDE CAR CO.,
Sole Manufacturers,
Three Rivers, Mich.

ESTABLISHED 1859.

PLATINUM.

H. M. RAYNOR,
25 BOND STREET, New York.

Telegraph and Electrical SUPPLIES

Medical Batteries, Inventors' Models, Experimental Work, and fine brass castings. Send for catalogue C. E. JONES & BRO. Cincinnati, O.
It is important to us that you mention this paper.

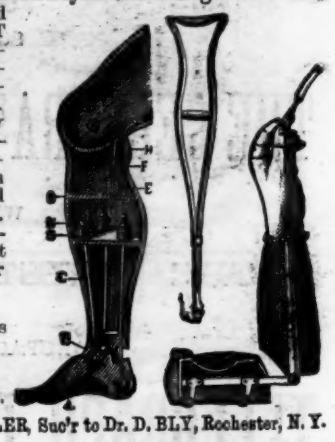
THE "ELGIN" TELEPHONE,
for Private Lines. Copied by many, excelled by none! Address for illustrated circular ELGIN TELEPHONE Co., Elgin Kane County, Ill., U. S. A. L. G. Tillotson & Co., 5 & 7 Dey St., Agents for New York.

The Celebrated Bly Artificial Legs and Arms.

Pronounced FIRST-BEST in U. S. Government competitive examination. Adopted by States of Virginia, Georgia, South Carolina and Louisiana. Recommended by the most eminent surgeons.

Crutches at various prices.

Send for Free Pamphlet.

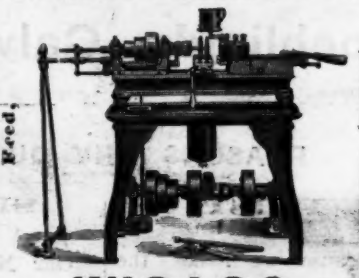


GEO. R. FULLER, Suc'r to Dr. D. BLY, Rochester, N. Y.

IMPROVED

SCREW MACHINES

OF EXTRA STRENGTH AND POWER, OF A SUPERIOR DESIGN AND FINISH.



With Automatic Wire Feed; And a Perfect Screw (Jaw'd) Chuck.

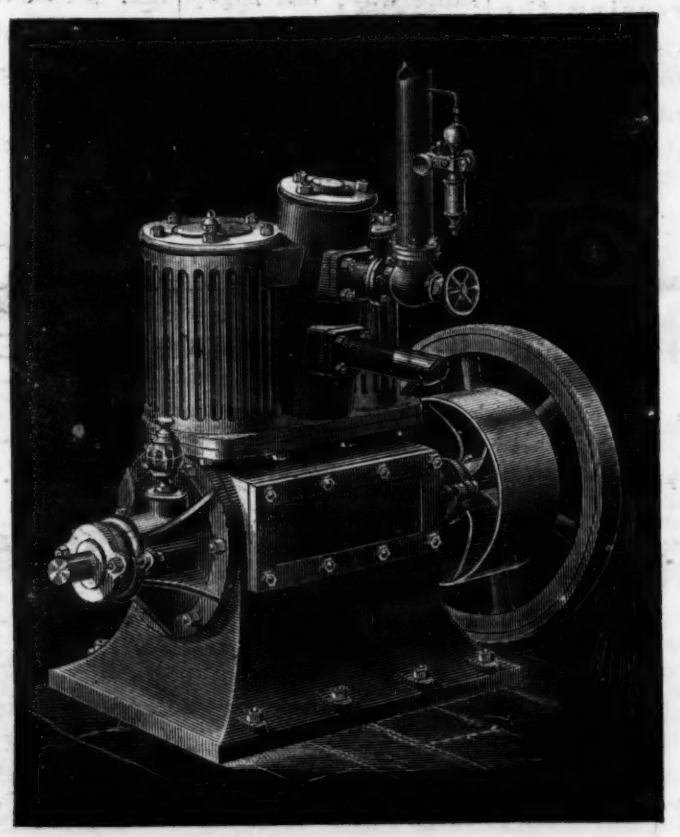
WICACO Screw and Machine Co.,

712 Cherry St., Philadelphia, Pa.

THE WESTINGHOUSE AUTOMATIC ENGINE

is undoubtedly the most popular Engine in the market for Electric Lighting, both for Private Lighting and Public Stations.

OVER 600 ENGINES NOW IN USE!



AVERAGE SALES, 1,200 H. P. PER MONTH!

It has no equal in sensitive Governing.
It occupies the least room.
It costs the least for Foundations.
It will run continuously, night and day.
It creates the least expense for attendance and repairs.
It belts direct, and avoids Countershafting altogether.
Its Price is Moderate.

Send for Illustrated Circular and Reference List.

THE WESTINGHOUSE MACHINE COMPANY,

PITTSBURGH, PA.

Or address, if more convenient, our following Branch Offices:

94 Liberty Street, New York. 14 South Canal Street, Chicago.
401 Elm Street, Dallas, Texas.